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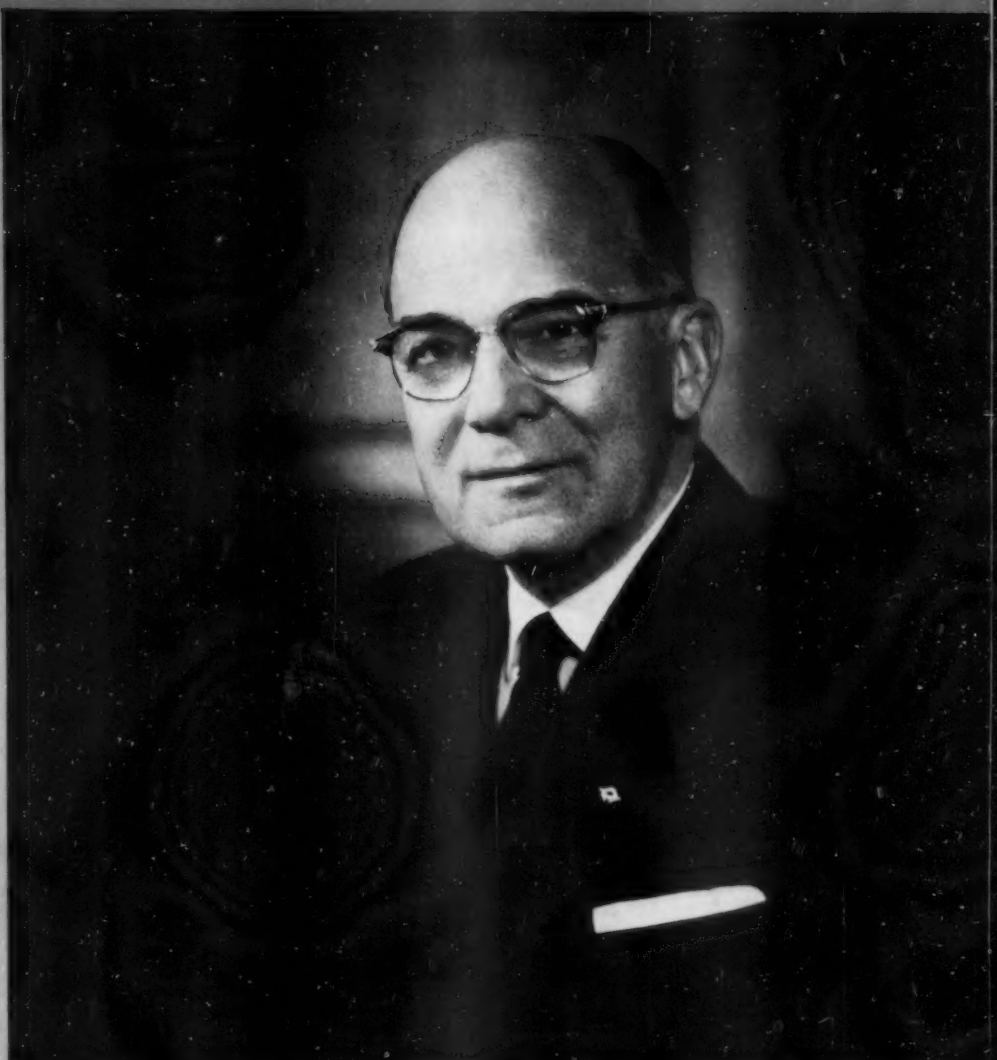

Edward E. Alt, long-time an engineering representative of the Chicago Bridge and Iron Company, is currently serving as President of the Water and Sewage Works Manufacturers Association. See page 18 for more data.

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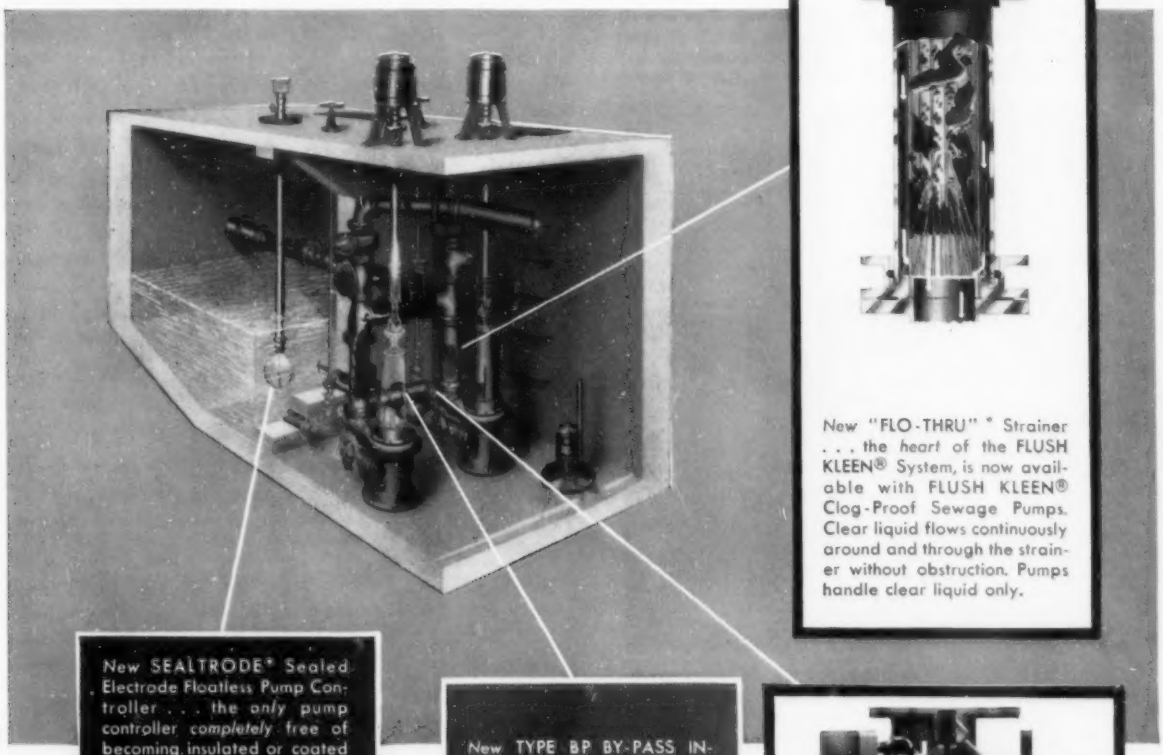

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No. 955 excavates part of a total of 19,000 yd., preparing for base an area 20 ft. wide, 12-13 in. deep. Cuts are made by Cat No. 12 Motor Grader and windrowed. Job is part of a $1,828,366 project by Gulf Bitulithic Co. on U. S. 75, to be part of the Interstate Highway System.

Says Operator F. H. Leggett: "I can move over 100 cu. yd. a day more with the side dump than with other loaders. It doesn't spill dirt because you don't have to jockey for position. A Traxcavator is easy to operate and I'm less tired at night. It's the best on the market."

Weather bad... No. 955 terrific... job on schedule!

The performance and versatility of a Caterpillar No. 955 Traxcavator with Side Dump Bucket was vividly demonstrated on a recent highway project in Texas. What happened is of importance to every municipal and county official concerned with the purchase of equipment.

Bad weather cut work days to 20 per cent during the first six months on a 2¼-mile widening job on U.S. 75 at Conroe, Texas. A drag line proved a poor producer in the shallow cut. Switching to a Cat No. 955 Traxcavator with Side Dump Bucket, Gulf Bitulithic Co., Houston, Texas, got the job back on schedule—and kept it there! Five-yd. trucks were loaded in an average time of three minutes; four buckets to the truck.

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PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

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BPA

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ROILINE ENGINES (Formerly LE ROI)

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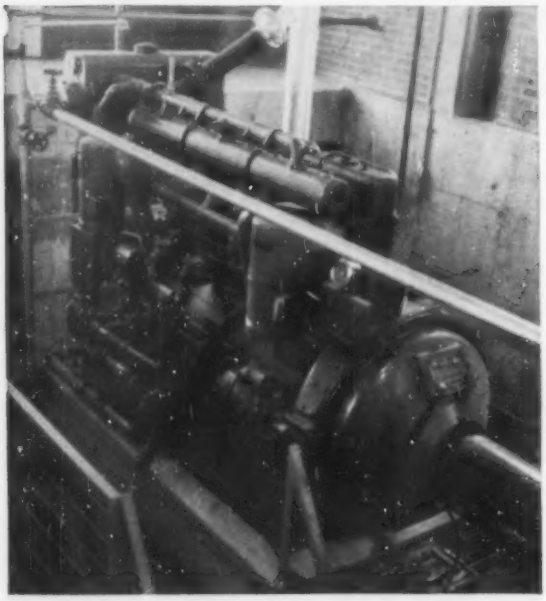
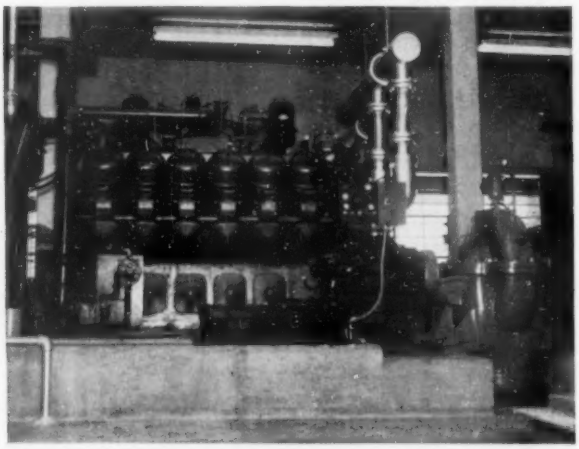
POWER FOR MUNICIPAL PLANTS

Three ROILINES pull the pumps at Oklahoma City's Lake Hefner Municipal Filtration Plant.



Model F-1500, maximum horsepower 215 at 1200 rpm on natural gas.

Model L-3460, maximum horsepower 595 at 1350 rpm on natural gas.



BASIC ENGINE CHARACTERISTICS*

GASOLINE OR NATURAL GAS					600	800	1000	1200	1400	1600	1800	2000	2200	2400
MODEL	Bore & S.	Cyls.	Displ.	Torque–rpm	BRAKE HORSEPOWER AT ENGINE SPEEDS INDICATED									
H540	4½ x 4¼	8	540	430- 900	. . .	64	82	99	115	130	143	155	164	170
H844	5¼ x 4⅞	8	844	637-1500	. . .	106	135	165	191	215	237	255	270	278
F1500	6¾ x 7	6	1503	1090- 650	125	165	200	215						
H2000	6¾ x 7	8	2004	1485- 650	170	225	270	290						
L3000	6¾ x 7	12	3006	2200- 650	250	335	405	435						
L3460	7¼ x 7	12	3468	2570- 900	285	391	492	568	595 @ 1350 RPM					
L4000	7.54 x 7.5	12	4000	2930- 900	325	446	560	645						

*With oil pump, water pump, magneto, air cleaner, carburetor, and exhaust muffler. Hp shown is maximum.

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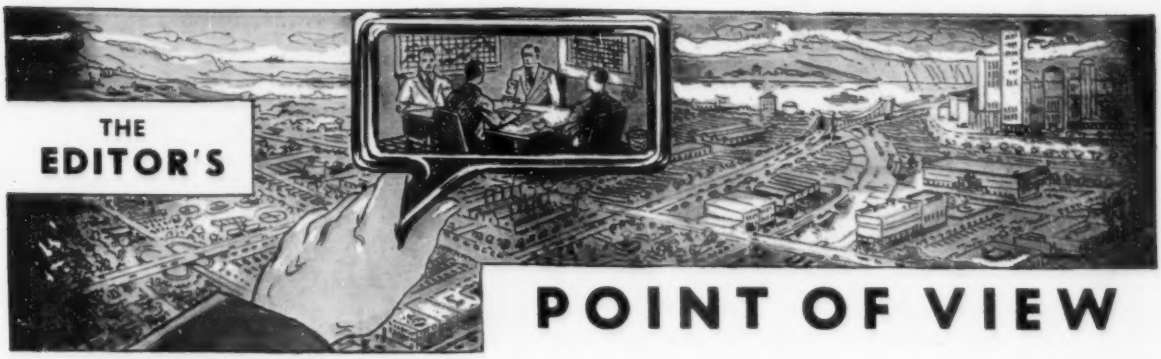

THE EDITOR'S POINT OF VIEW

Sewage Treatment for Unincorporated Areas

THE PROPOSAL by North Carolina to place stream pollution responsibilities for unincorporated towns in the hands of County Boards of Commissioners is very sound. In our Eastern States, governmental units do not have responsibility for providing sanitary facilities in unincorporated areas. As a result, usually nothing is done until conditions get so bad that just about the most stubborn diehard can't stand it any longer.

With the trend toward residential developments outside incorporated areas, the need for more modern political machinery for providing sewage treatment facilities has been intensifying. The sound leadership being provided by one of our most progressive states should encourage others to take similar steps.

What Will Construction Costs Be In the Future

EVER SINCE engineering began, needed public works have been deferred because they cost too much. In most cases these works had to be built eventually and generally at an increased cost. There is little chance that construction costs will go down; it is more likely that they will continue to rise for an indefinite time in the future. So nothing will be gained by waiting; the chances are that there will be a loss instead in that the cost will be higher in the future.

It is interesting to speculate on how many needed public works have been deferred because someone lacked salesmanship and was unable to present the facts regarding the need and the advantages clearly enough for the voters to understand and appreciate the situation.

One of the Neglected Phases of Public Works Engineering

IT IS EASY to let a refuse incinerator deteriorate because, like any other piece of modern equipment under severe service, it needs intelligent and skilled operation as well as timely maintenance. It is just as easy to let the sanitary fill turn into an ugly dump because the people actually operating it have not been taught what the word "sanitary" means. Our cities and counties need more incinerators and more sanitary landfills, but they also need better operation of what they have.

This has been a field in which leadership by health authorities has been sorely lacking, though our home state of New Jersey is a shining exception to the rule. This lack of leadership means that most of our cities and counties must turn to other sources for help. Fortunately consulting engineers and the manufacturers of equipment for landfill and for incineration are able and willing to provide aid.

The changes in the character of refuse over the past ten or fifteen years have profoundly affected incinerator design, but it does not mean that the present incinerator is unable to do a good job if modifications in design to accommodate these changes are made. We suggest that, instead of reverting to the old dump, a qualified consulting engineer, skilled in incinerator design, be asked to review the existing plant and make suitable recommendations for modernization. Likewise, either a consulting engineer or a staff engineer of one of the companies furnishing equipment for sanitary landfill can do a great deal to get sanitary landfill operations back on the proper track. Too few consulting engineers have specialized in landfill operations; therefore the equipment engineer can often render a service which otherwise is unavailable.

In any case, a new look at the refuse disposal problem is needed. It is something we will always have with us and the sooner it is solved satisfactorily the less public money will be spent without getting adequate returns on the expenditure. The growth of our metropolitan areas, with hundreds of independent governmental units having responsibility for waste disposal, accentuates the necessity and the urgency of the need for action and for leadership.

How Efficiency of Equipment Decreases With Age

A TEST conducted by one of the leading makers of motor trucks, based on the performance of 499 pick-up type, trucks showed that new trucks used 25.6 to 27.5 percent less gasoline than trucks 6 years old or older. This, of course, is only one factor in the high cost of using overage equipment. Other costs, usually much more important, are reduction in personnel efficiency due to mechanical failures, losses due to down-time and the lesser efficiency of older equipment. It doesn't pay to use outdated equipment with our present work load and today's wages.

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. . . SAN FRANCISCO, JULY 12-17

LINK-BELT offers a complete equipment line for

preliminary water treatment

Municipal water departments *everywhere* look to Link-Belt for *everything* it takes for efficient preliminary treatment of water. There's Link-Belt equipment designed to take it every step of the way up to final filtration and chlorination treatment.

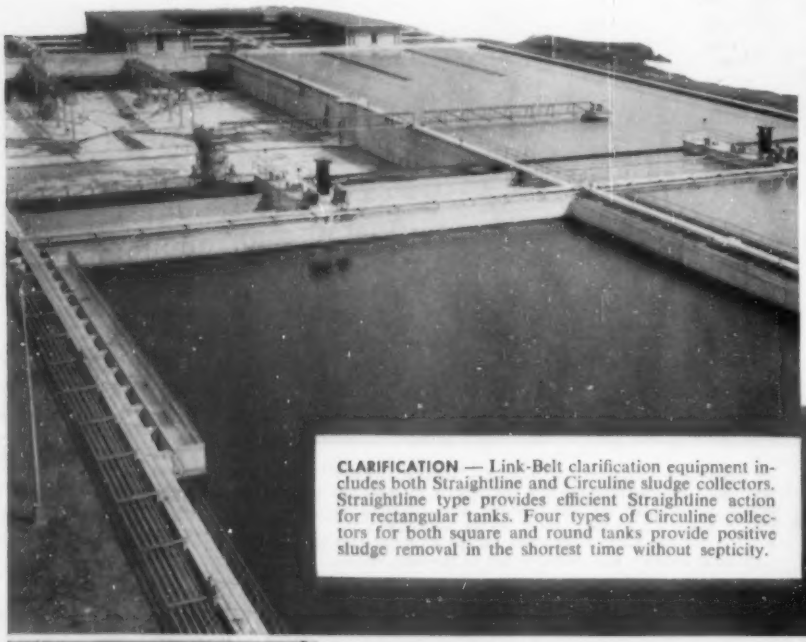
This extensive Link-Belt line is your assurance of impartial recommendations directly determined by your requirements. Moreover, recommendations can be acted upon promptly—thanks to 40 strategically located Link-Belt district offices.

Call the Link-Belt office nearest you for consultation with a sanitary engineering specialist. He will gladly work with your own chemists and consultants. Catalogs sent on request.

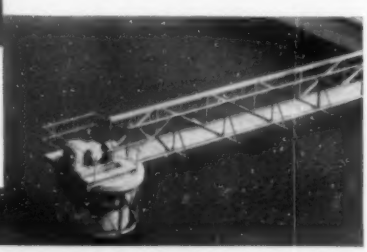
INTAKES include trash, Tritor, disc and drum screens. Link-Belt trash screens (pictured) are operated intermittently, removing large floating debris to protect water screens and other equipment from damage.

FLOCCULATION — Link-Belt makes both horizontal and vertical Straightline slow mixers for efficient chemical flocculation. Pictured are horizontal slow mixers for rectangular tanks, cross or transverse horizontal flow.

CHEMICAL HANDLING —Link-Belt builds a complete line of conveyors and elevators in all types and sizes for handling bulk or packaged chemicals. Also Syntron chemical feeders. Shown are Link-Belt screw conveyors and bucket elevators.



CLARIFICATION — Link-Belt clarification equipment includes both Straightline and Circuline sludge collectors. Straightline type provides efficient Straightline action for rectangular tanks. Four types of Circuline collectors for both square and round tanks provide positive sludge removal in the shortest time without septicity.



FLASH MIXERS — Continuously, rapidly and thoroughly mix chemicals prior to flocculation . . . prepare chemicals and water for immediate flocculation.

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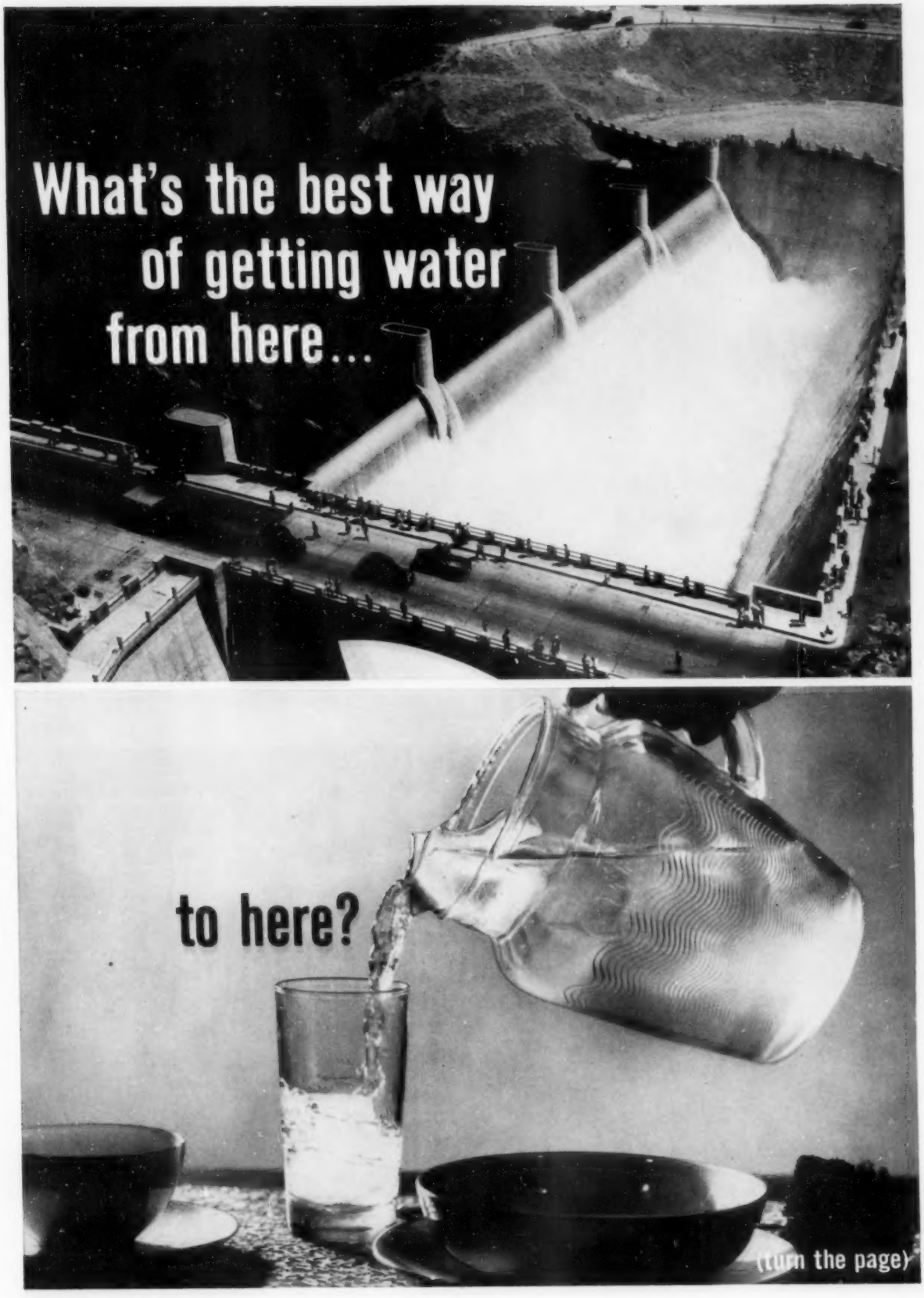
What's the best way
of getting water
from here...
to here?
(turn the page)

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America's greatest water carrier

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Why do we say that?

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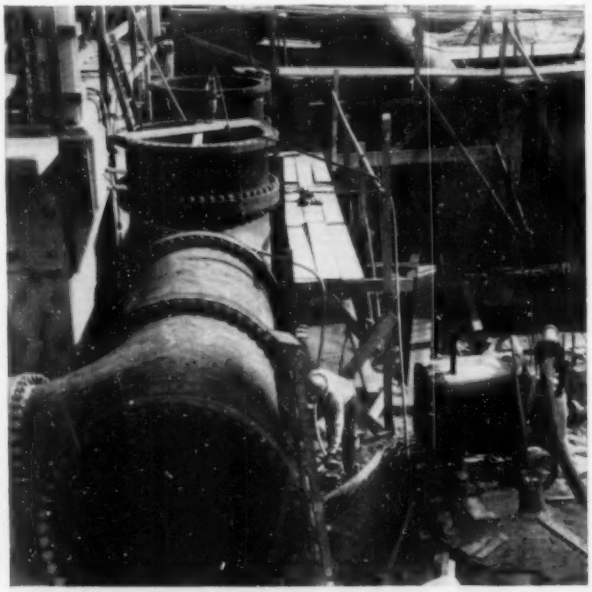
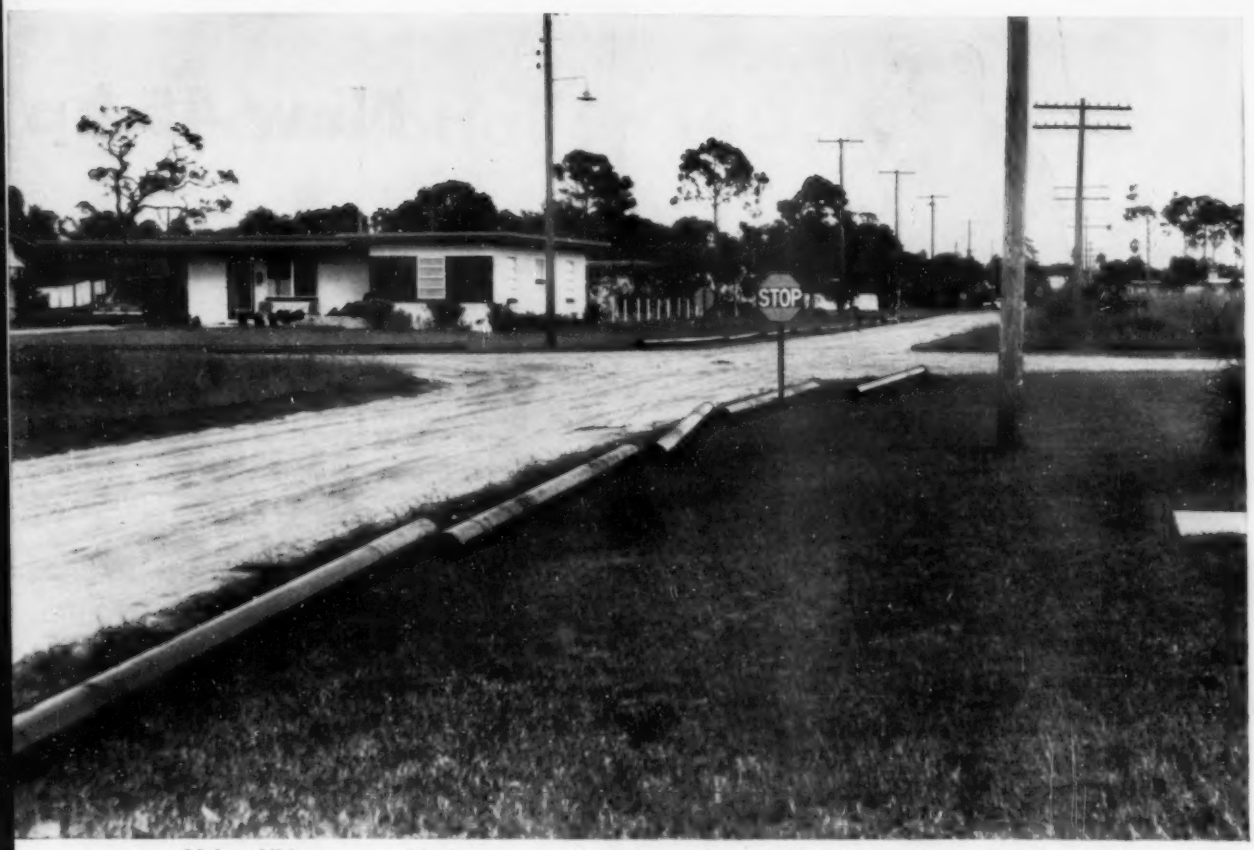
Furthermore, more miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.

Yes, cast iron is always the favorite. A recent impartial survey showed that consulting engineers and water utility officials prefer cast iron pipe for underground water distribution by an overwhelming majority.

Eight-inch cast iron pipe ready for installation of 2-main water system in new subdivision.



Installation of 60-inch flanged pipe and fittings for circulating condenser water in a power plant.



Major additions to a municipal water system totaled 116,080 feet of slip-on joint cast iron pipe in 6-, 10- and 12-inch sizes.

Private water company main extension of 6-inch slip-on joint pipe for housing development.

What are its advantages?

- LONG LIFE. The cast iron pipe you install today will be performing economically a hundred years from now.
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. . . good reasons for <u>you</u> to choose

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POWER • SPEEDS • STEERING • EQUIPMENT

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5 speeds forward, one reverse, with regular transmission.

5 speeds reverse . . . 5 speeds forward with Fast Reverser for faster cycles on shuttle-type work. Go 22½ *per cent faster* in reverse than in corresponding forward gear. Or . . .

10 speeds forward with exclusive IH Torque Amplifier drive. Boost pull- or-push-power on-the-go in any gear without shifting.

Planetary steering allows for feathered or pivot turns with minimum physical effort. Simple, rugged design simplifies maintenance.

Exclusive, advanced hydraulics deliver 12 or 17 gpm from constant-running, *internal-mounted* pump. Controls heavy duty loaders and a wide range of hydraulically-controlled front-mounted, rear-mounted, or trailing equipment.

Husky track frames, shoes, links, rollers, pins, and bushings assure long track life.

New International Drott T-340 Four-In-One Skid-Shovel—combines in one machine a bulldozer, clamshell, carry-type scraper, and ¾ cu yd bucket (⅞ cu yd heaped), all hydraulically controlled.

New International Wagner backhoe and loader—can be mounted separately or in combination. Self-leveling loader has 3,500-lb capacity.

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with crawler traction

Here's power and performance entirely new to the utility crawler field! It's the new International T-340 with power, speeds, job range, and handling ease entirely new to small crawler operation. You now can profit from crawler pull-power and flotation . . . with proven IH stamina and dependability . . . scaled in cost to the multitude of jobs where you can't afford to tie up bigger, more costly equipment. With such job-matching options as Torque Amplifier, Fast Reverser, and big-capacity internal hydraulic system, coupled with new planetary-type steering, the new T-340 offers production-boosting features not even available in many larger crawlers!

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"This Chevrolet 10403 model is giving us up to 48% better gas mileage."

—CLYDE J. McLELAND, SUPT., STEUBEN COUNTY HIGHWAY DEPARTMENT, ANGOLA, INDIANA

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"We decided this year to try the advantages of an automatic transmission. Chevrolet Powermatic answered our need perfectly. We have found that it is more economical from both a fuel and maintenance standpoint because it's practically impossible to 'lug' the engine."

Chevy, you'll find, is winning a lot of new boosters among municipal managers, for a number of good reasons. Reasons like money-saving *power*, for instance. Chevrolet for '59 offers newly improved valve-in-head 6's that nurse a gallon of gas like nothing in trucks has before. Or big V8's for every Series that include the shortest stroke design—the best saving design—in the field. And for the *toughness* that leads to low maintenance, Chevy's advanced chassis components are specially designed for the capacity to out-muscle the roughest kind of runs. For the *latest* in low-cost hauling equipment, see your Chevy dealer! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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MAKE SURE

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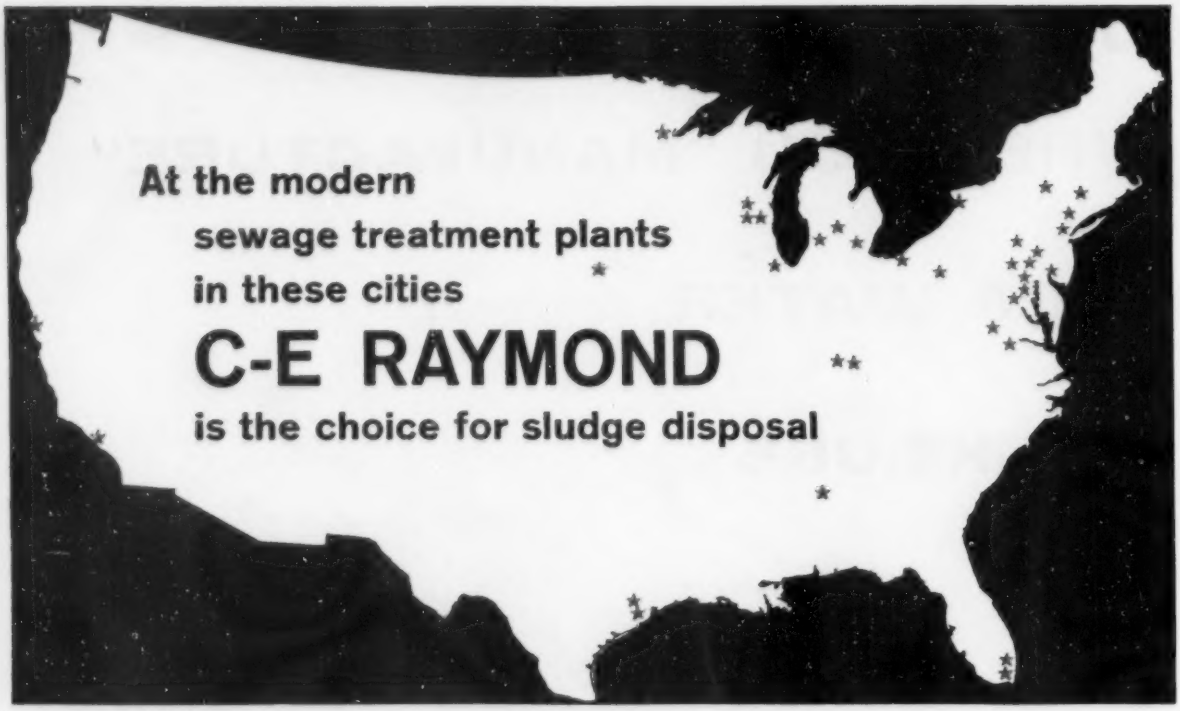
the nameplate of dependability

USE THE BEST "MACHINERY"



Here are some reasons why the C-E Raymond Flash Drying and Incineration System has been selected by treatment plants throughout the country . . .

Flexible – It reduces filter cake to non-lumpy particles of uniform low moisture content without scorching . . . a product very suitable for use as soil conditioner . . . or if sludge characteristics render it unfit for this use, quickly incinerates it to a sterile ash. It is available with high temperature deodorization and fly ash collection.

Efficient – It assures built-in plus-performance for effective and controlled drying of filter cake with high *thermal* efficiency. This means less fuel cost penalty when incinerating low heat-content sludges since design thermal efficiency can be consistently maintained.

Advanced – It incorporates small groups of arch bricks individually hung from steel supports rather than relying upon self-supporting refractory arches. This requires little maintenance, makes arch failure virtually impossible, and permits rapid start-ups . . . less than 30 minutes for furnaces capable of burning in excess of 120 tons of filter cake daily. It has the most fully automatic controls for drying and furnace operation of any system available.

Proven – It is the most widely used method for heat disposal of sewage sludge. More filter cake is dried and/or incinerated in the C-E Raymond System than in all other systems combined.

For further details contact the Combustion Engineering office nearest you. Our engineers will be happy to discuss, with you or your consultants, how this system can benefit your community.

★ **Communities in the United States which have selected C-E Raymond for sewage sludge disposal**

Baltimore, Md.
Battle Creek, Mich.
Bethlehem, Pa.
Bloomsburg, Pa.
Buffalo, N. Y.
Camden, N. J.
Chicago, Ill.
Coral Gables, Fla.
Cuyahoga Falls, Ohio
Duluth, Minn.
Fond du Lac, Wisc.
Galveston, Texas
Harrisburg, Pa.
Houston, Texas
Jefferson Co., Ala.
Lansing, Mich.
Los Angeles, Calif.
Louisville, Ky.
Lynchburg, Va.
Miami, Fla.
Neenah-Menasha, Wisc.
New Albany, Ind.
New Rochelle, N. Y.
Omaha, Neb.
Petersburg, Va.
Pittsburgh, Pa.
San Francisco, Calif.
Schenectady, N. Y.
Sheboygan, Wisc.
Springfield, Mass.
Warren, Mich.
Washington, D. C.
Waterbury, Conn.
Wyomissing Valley, Pa.
York, Pa.

COMBUSTION ENGINEERING

RAYMOND DIVISION

C-E

C-211

1132 West Blackhawk Street, Chicago 22, Illinois

Eastern Office: 200 Madison Avenue, New York 16, N. Y. • Western Office: 510 West Sixth Street, Los Angeles 14, Calif.

Canada: Combustion Engineering-Superheater Ltd.

ALSO FLASH DRYING AND INCINERATION FOR INDUSTRIAL WASTE DISPOSAL

Truck operators derive many worthwhile benefits through the use of Eaton 2-Speed Axles—ability to pull out under full load, quicker trips, safer operation, reduced driver fatigue, longer truck life, greater trade-in value.

But a big reason why more and more truckers in all fields of heavy duty hauling are specifying Eaton 2-Speed Axles is that this equipment effects important reductions in operating and maintenance costs—which is another way of saying: they add to profits!

Ask your truck dealer to show you how Eaton 2-Speed Axles can make big savings in your hauling operation.

EATON

More than Two Million
Eaton Axles in Trucks Today.

EATON — *AXLE DIVISION*

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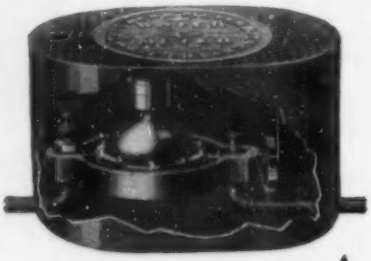
CLEVELAND, OHIO

PRODUCTS: Engine Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Hydraulic Pumps Truck and Trailer Axles • Truck Transmissions • Permanent Mold Iron Castings • Automotive Heaters and Air Conditioners Fastening Devices • Cold Drawn Steel • Stampings • Forgings • Leaf and Coil Springs • Dynamatic Drives and Brakes Powdered Metal Parts • Gears • Variable Speed Drives • Speed Reducers • Differentials • Centralized Lubrication Systems

CLARK METER BOXES AND COVERS
OF CAST IRON

Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.



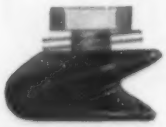
Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.



Improved Screw Lock with strong forged bronze bolt.

Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

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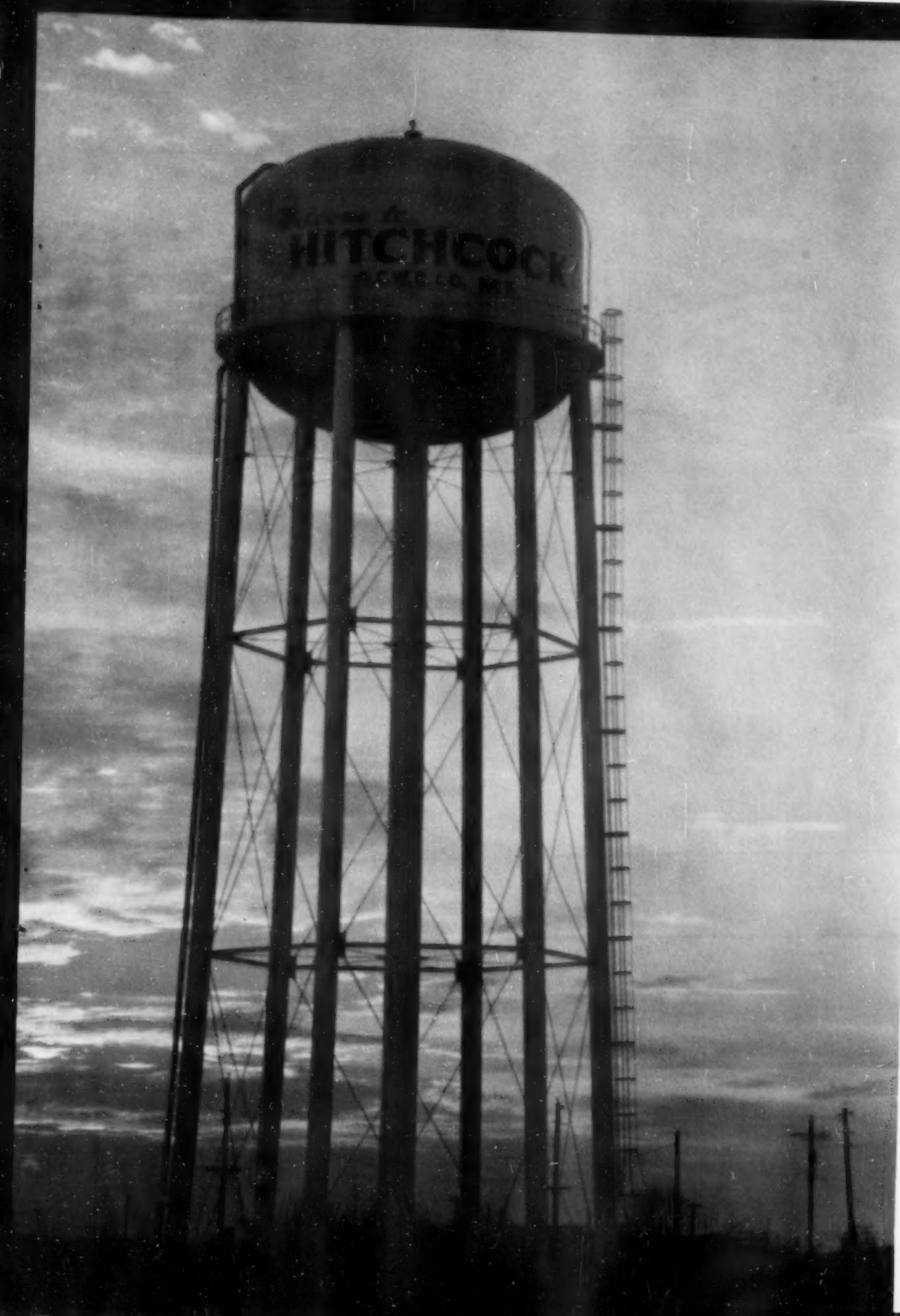
H. W. CLARK CO.
MATTOON, ILLINOIS

Edward E. Alt is the president of the Water and Sewage Works Manufacturers' Association for 1959. He has represented Chicago Bridge & Iron Co. on the WSWMA Board of Governors for the past five years. A native of Chicago, he studied engineering at Northwestern University and Massachusetts Institute of Technology. He joined the Engineering Department of Chicago Bridge & Iron Co. in 1918, being transferred to sales in 1920. He has been a member of the sales staff since that time except for a three-year period during World War II when he served as personnel director at the CBI Seneca, Ill., shipyard.

Mr. Alt has long been active in the water works industry and prominent in state and national associations in the water works field. He is, at present, Chairman of the Steel Tank Affiliate of the Steel Plate Fabricators Association; a member of the Water Resources Committee of the Illinois State Chamber of Commerce; a member of the Illinois Society of Professional Engineers; and a member of several AWWA Committees. He is past chairman and director of the Illinois Section AWWA and, in 1956, received the George W. Fuller award for outstanding service to the Section.

As president of the WSWMA, during the coming year Mr. Alt will cooperate with the American Water Works Association in developing the Water Utility Advancement Program now under way by the AWWA.

Mr. Alt is a 32nd degree member of the Masons; and of the Knights Templar and the Oriental Consistory; and a life member of the Shrine.



FILE REFERENCE

FACT SHEET

GRAVER

Uniform Water Pressure Now Assured for Hitchcock, Texas

Galveston County Water Control & Improvement District No. 7 at Hitchcock, Texas
Paul W. Anderson, President
C. Lee Clark, Superintendent
Chas. R. Haile Associates, Inc.
Consulting Engineers, Houston and Texas City, Texas
Graver Tank & Mfg. Co.
Division—Union Tank Car Company
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 250,000 Gallons
Height to Overflow: 129' 2"
Head Range: 29' 2"
Diameter of Tank: 40' 0"
Built to AWWA Specifications
Painted and Sterilized

THE PROBLEM

A population growth of from 1,500 in 1952 to 4,500 in 1957, needless to say, placed a substantial strain on the water supply system of Hitchcock, Texas, a predominently residential community located 15 miles northwest of the City of Galveston. The existing system consisted of a part of the water system from adjacent Camp Wallace, which was purchased from the War Assets Administration and reinstalled, as well as the water system at the nearby Naval Air Station which was bought and re-activated where it stood. Of prime importance to the health, welfare and continued growth of Hitchcock was the necessity of extending the present water services.

THE SOLUTION

To the present water works system consisting of two wells, a 50,000 gallon standpipe, a 50,000 gallon elevated water tank, and a 500,000 gallon surface reservoir, the consulting engineers recommended that a 250,000 gallon elevated water tank be added on the opposite side of town. A new 250,000 gallon surface reservoir was also recommended. The pumping facilities were increased, as were the water lines, to provide the additional service required.

The new 250,000 gallon elevated water tank now helps to distribute the water pressure evenly throughout the community. This is another example of how farsighted communities are planning for the future with the help of Graver, which designed, fabricated and erected the elevated tank at Hitchcock. Painting and sterilizing were also Graver's responsibility.

When water pressure becomes your problem, look to an elevated tank by Graver for a thoroughly satisfactory—and economical—solution.

Whether your requirements are a 25,000 gallon tank or one holding 3 million gallons, you will find Graver particularly skilled in fabricating and erecting elevated water tanks to the most exacting specifications of your own engineers and your water works consultants.

Over a century of craftsmanship in steels and alloys are at your call at Graver.

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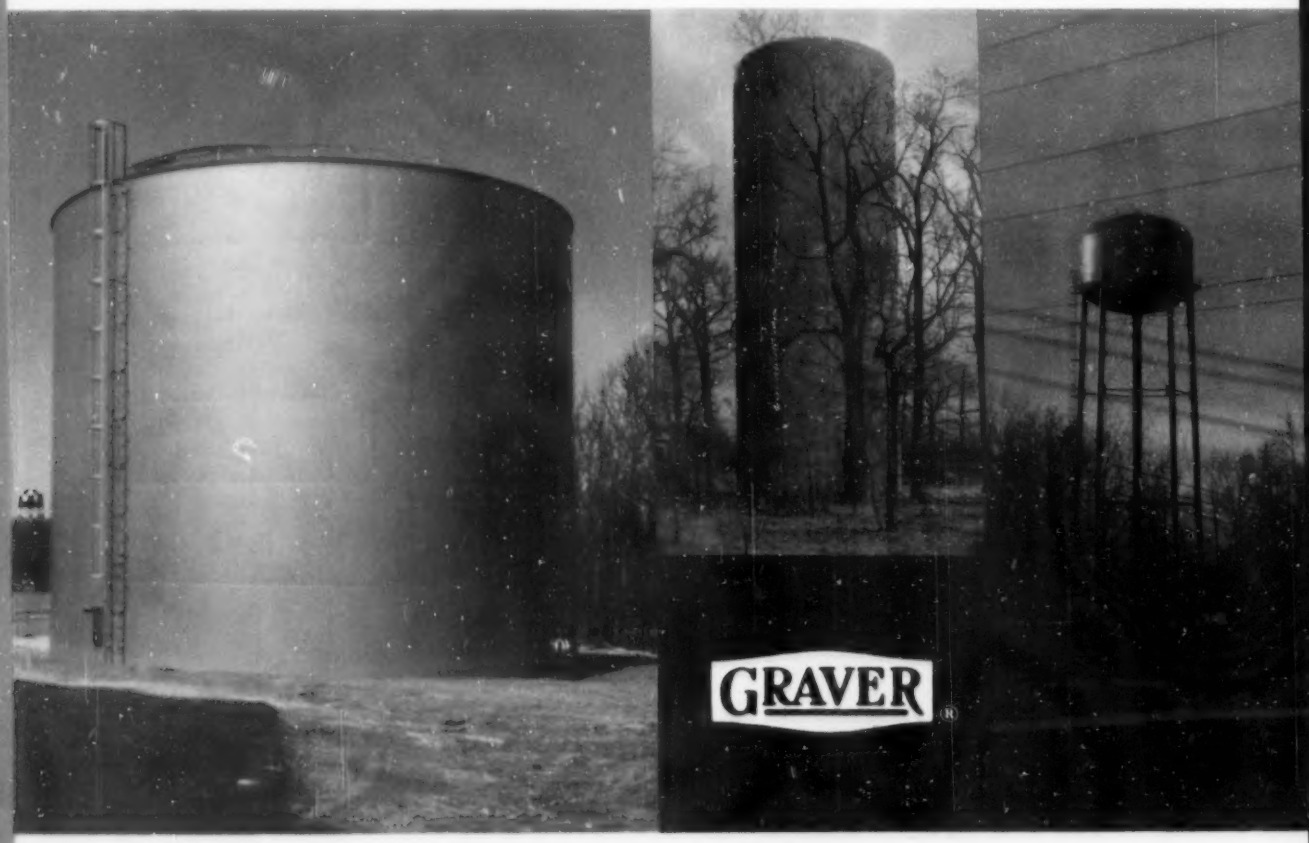
OVER 100 YEARS OF EXPERIENCE

by Graver in fabricating and erecting tanks of all types for many purposes will provide, in collaboration with your consulting engineers and water works officials, the most suitable tankage for your water storage needs.



The reservoir, standpipe and elevated tank shown are only a few examples of how Graver solves water storage problems. GRAVER TANK & MFG. CO.

DIVISION—UNION TANK CAR COMPANY

EAST CHICAGO, IND. • Plants and Offices Across America

WHEN CITIES PLAN INDUSTRIAL GROWTH

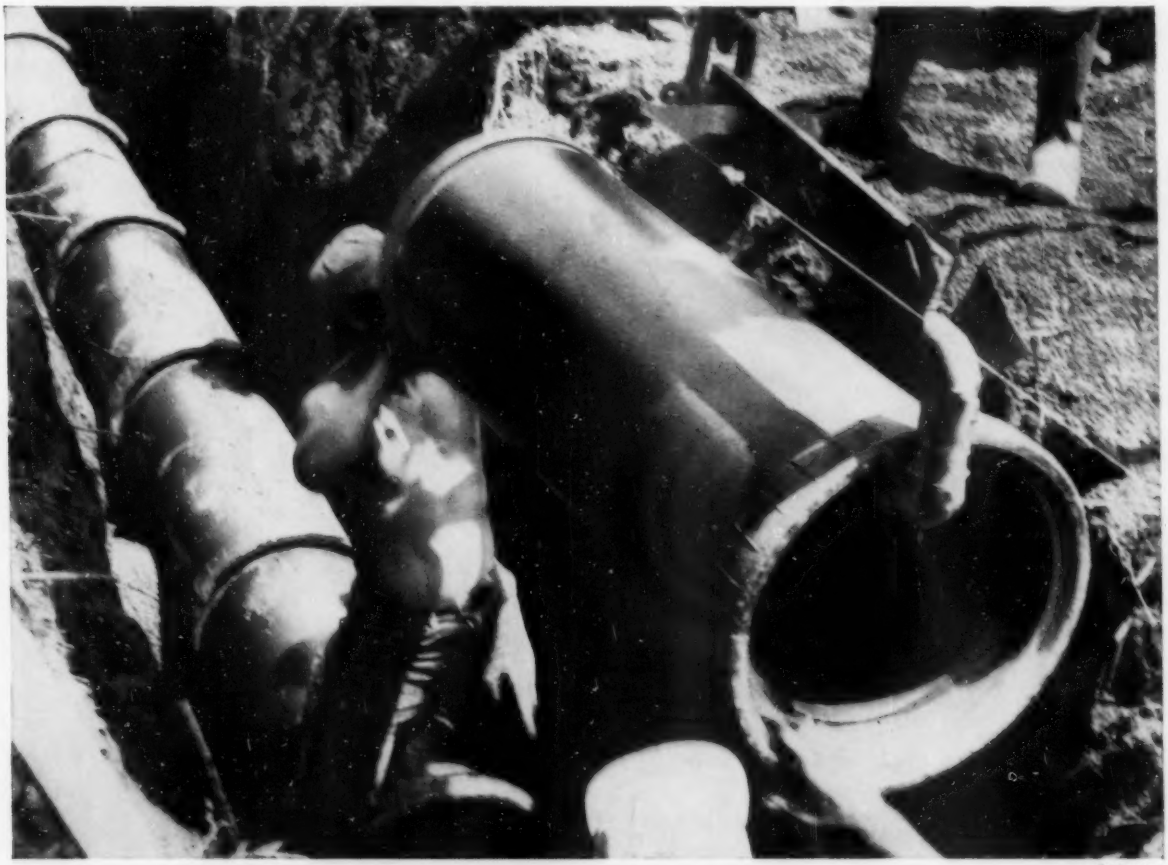
it pays to specify Vitrified Clay Pipe

SANTA PAULA, CALIFORNIA, already a bustling center of agricultural activity, is building to share in California's phenomenal industrial growth. To accommodate new industry and meet the needs of a growing population, Santa Paula recently completed a bond-financed sewer expansion project, using Vitrified Clay Pipe exclusively. Over 6 miles of Vitrified Clay Pipe were installed.

Like Santa Paula, growing communities everywhere need the permanence and safety that only Clay Pipe can provide. Clay Pipe is the only pipe that never wears out . . . does not rust, rot, corrode, or crumble. And with its new research-developed, factory-made joints, Clay Pipe is faster and easier to install than ever before.

When your community plans new sewerage facilities, be sure to consider the exceptional advantages of Clay Pipe. Its exclusive long-term guarantee is your assurance of permanent, maintenance-free service. Only Clay Pipe has *all* the features you can trust to handle industrial growth.

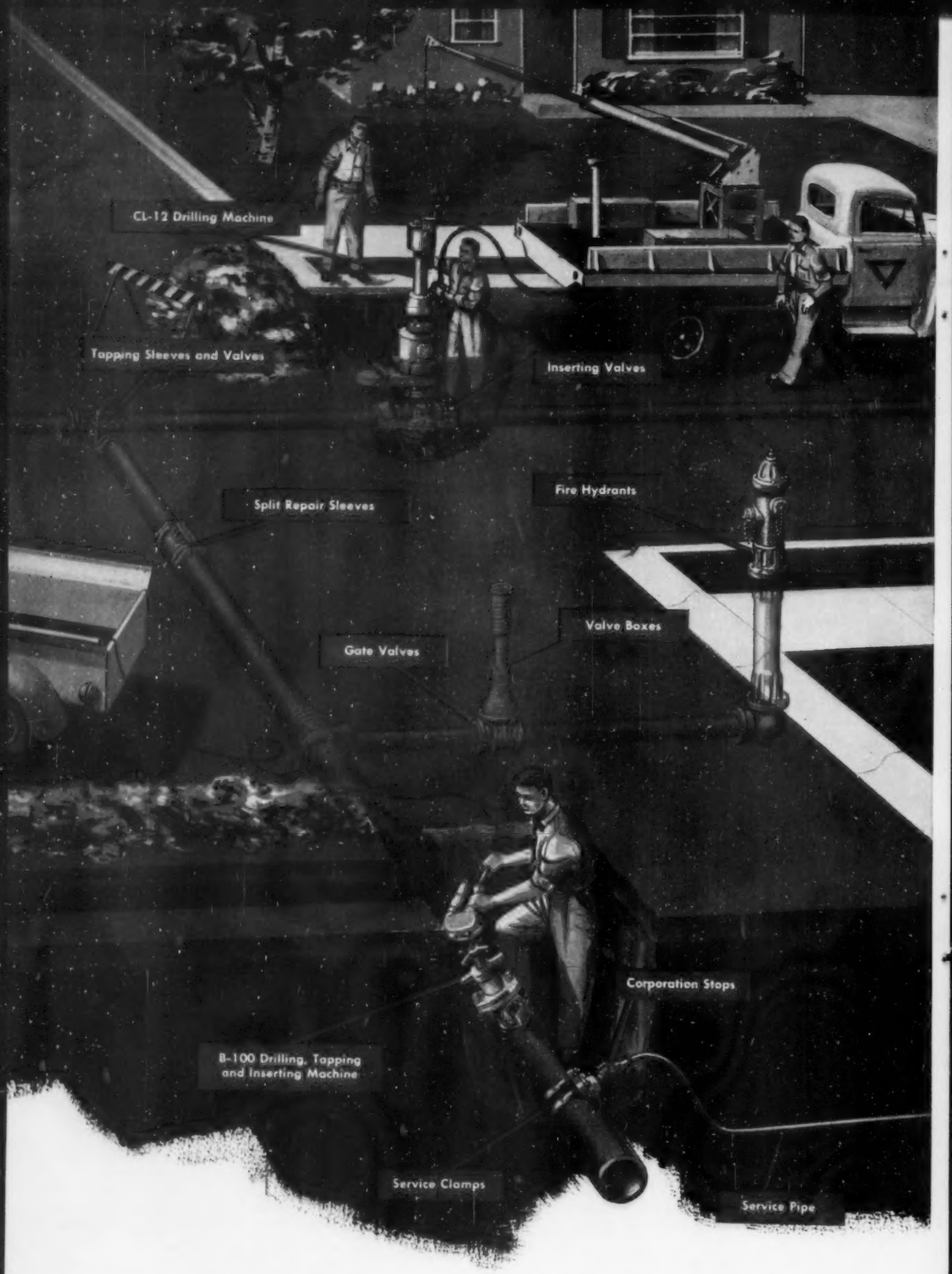
CITY OFFICIALS: James E. Leary, Mayor; Edwin C. Bixby, Ernest H. Oman, Ralph B. Crawford, Reece B. McCalister, Councilmen.
CONSULTING ENGINEERS: J. M. Montgomery Engineering Co. **CONTRACTOR:** N. P. Van Valkenburgh Co.



C-159-2A

Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 783 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 1401 Peachtree St., N. E., Atlanta 9, Georgia


CL-12 Drilling Machine
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B-100 Drilling, Tapping and Inserting Machine
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Gain longer, more dependable service with reduced maintenance costs. Insure uniform product quality and reduced costs by utilizing one source of supply.

Specify the complete line of water works products—equipment backed by over a century of manufacturing experience and technical "know how".

Specify Mueller, all along the line.

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
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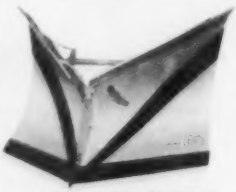
WAUSAU 3-WAY Plow and Truck Grader Ice Blade as furnished U.S. Air Force

WAUSAU EQUIPMENT IS BUILT TO "take it"

WAUSAU has maintained its leadership since the pioneer days of snow plowing through constant improvement in manufacturing techniques, the use of alloy metals and by closely engineering snow plows to the added power and speed of new trucks. The name WAUSAU on your snow plow will always remain a symbol of quality.



VEE TYPE PLOWS

The severe storms of last winter again prove the Vee Plows to be indispensable. There are 14 Models of WAUSAU Vee-Type Plows to fit anything from a farm tractor to a 54,000 GVW truck.

HIGH SPEED BLADES

Now available in discharge heights from 4' to 7' in a wide selection of shapes . . . designed for trucks of 2 tons to 15 tons capacity.

TRIP BLADE PLOWS

Trip Blade Snow Plows are practically standard equipment for city use—but only WAUSAU builds Trip Blades with simple, self-cleaning, readily adjustable compression springs . . . 12 Models available for almost any motive power.

TRUCK GRADER ICE BLADE

Truly a versatile year 'round maintenance unit . . . maintains, cuts and grades gravel, dirt roads, etc. . . . planes, breaks, removes ice and hard packed snow . . . full hydraulic cab control.

MATERIAL SPREADERS

Quick action, low cost self-contained unit . . . sturdily built . . . 8' to 20' spread width — hopper capacity 2 cubic feet.

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today for the name of your nearest WAUSAU distributor who will assist you in getting year 'round maintenance equipment to fit your needs.

SNOW PLOWS . . . 55 MODELS — 9 STYLES

WAUSAU IRON WORKS WAUSAU, WISCONSIN

Pioneer Snow Plow Builders

Truck Grader Ice Blade and Material Spreaders

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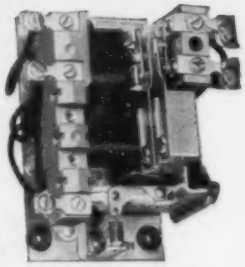
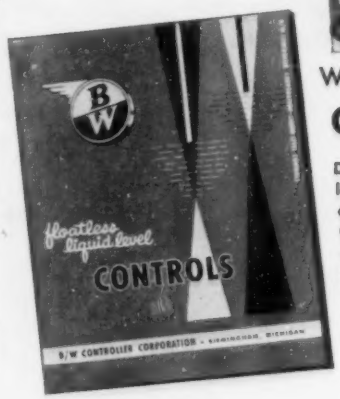
● Accurate! Automatic! No floats! No moving parts in liquid. Pioneered by B/W in 1933. Controls not affected by temperatures, pressures, acids, or caustics. Remote control if desired. Ice free electrodes when necessary.





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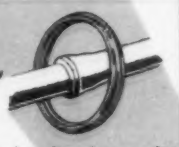
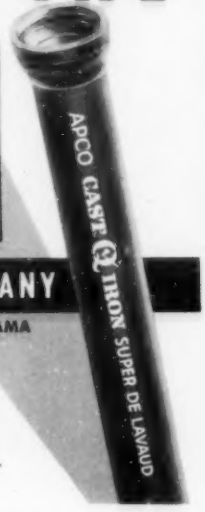
In sizes 3" to 24" in modern long lengths. Bell and spigot, roll-on-joint and mechanical joint.

For water, gas and sewage.

For The Best Connection You'll Ever Make Investigate The New ALTITE JOINT® by APCO



Underwriters Approved
Patent Applied For.



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- ★ 2800 Sherman dealers throughout U. S. and Canada assure you of prompt parts and service for dependable and economical operation.

AND . . . for the first time, the all new Sherman Loader is available as companion equipment. With 2000 lbs. lift, 4000 lbs. breakaway capacities. (2500 lbs./5000 lbs. for Ford Industrial or Fordson Power Major tractors.) The improved Panther and new Loader give you an excavating-materials handling unit that outperforms, outmaneuvers any comparable equipment on the market today!

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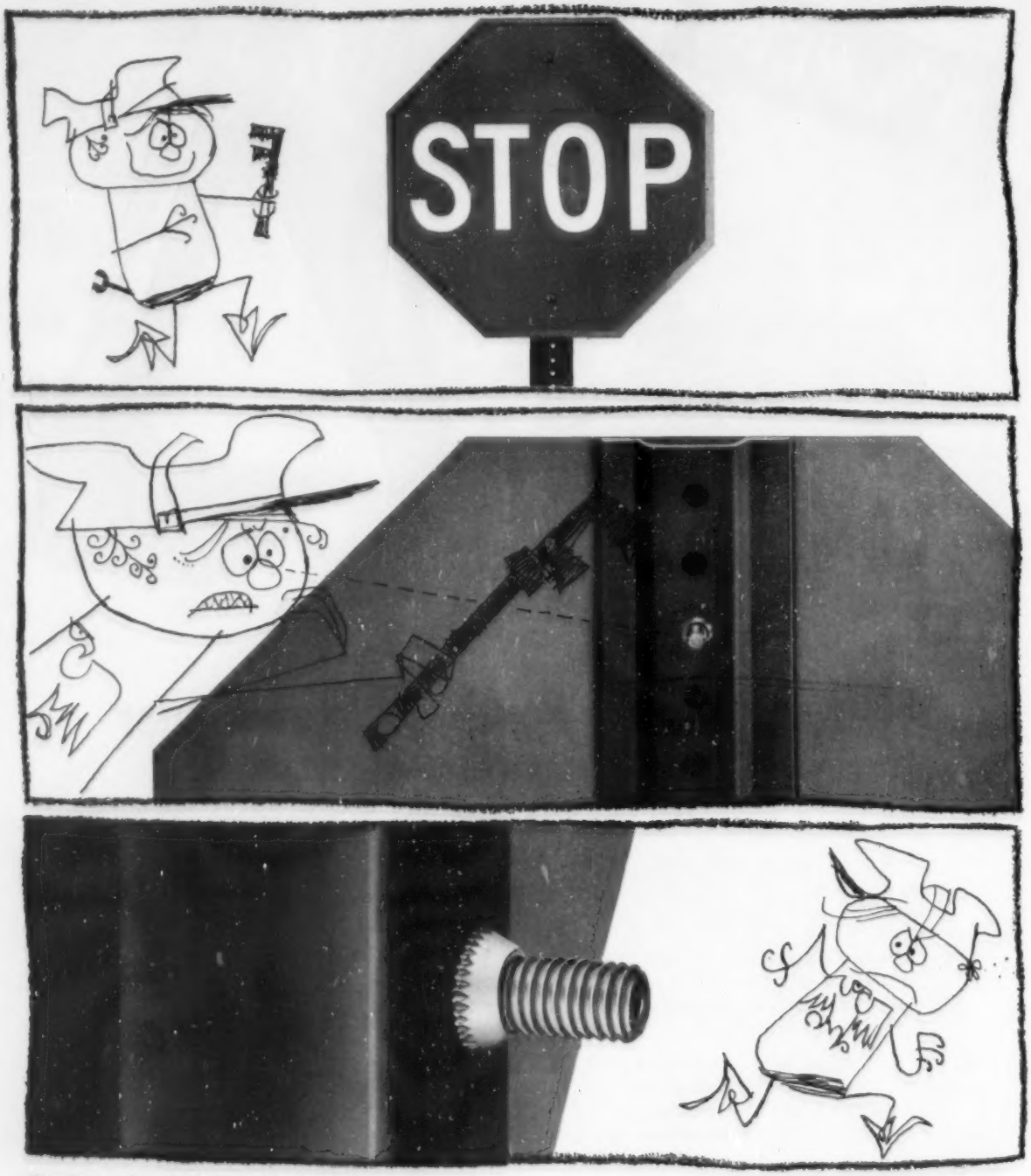

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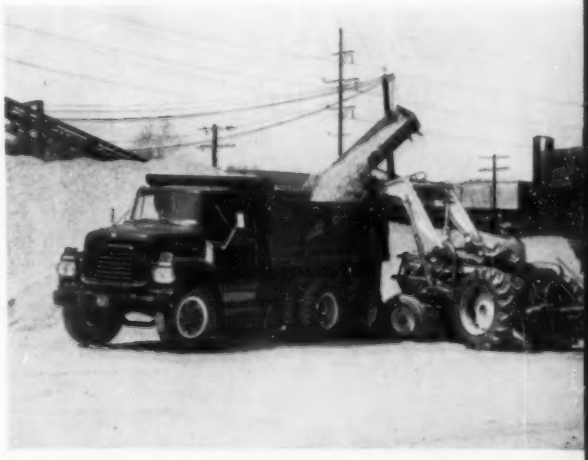
Faster cycles . . . no traffic tieups with new

SIDE-DUMP LOADER *on rubber!*

How you can get single-pass, single-lane loading combined with the mobility and economy of utility wheel tractor operation. Loading street sweepings or snow, for example, the tractor need never leave the parking lane!

This new loader is now available on the heavy-duty four-cylinder International® 340 Utility, and the extra-heavy-duty, six-cylinder International 460 Utility tractors. Large-capacity internal hydraulic system eliminates need for front-mounted pump. Either tractor can be equipped with Fast Reverser, providing five reverse and five forward speeds.

Call your IH Dealer—arrange a demonstration! For dealer's name and side-dump loader specification sheet, write International Harvester Company, Dept. PW-7, P. O. Box 7333, Chicago 80, Illinois.



Less maneuvering, more storage space! Side-dump loader can operate in confined areas, making more room to stockpile street repair and construction materials, salt for ice control, and similar bulk supplies.

See your

INTERNATIONAL HARVESTER *dealer*

International Harvester Products *pays for themselves in use*—Farm Tractors and Equipment . . . Twine . . . Industrial Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois.

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Instead of Hours with PENNDRILL

Holes can be drilled thru any type masonry material—concrete, marble, brick and tile; including reinforcing bars or other steel encountered.

Using diamond bits as the cutting agent, holes are drilled faster and at a lower cost than by any other method.

Penndrill equipment is designed for drilling holes vertically, horizontally or at any angle. Fast cutting, long life diamond bits in stock from 3/16" to 14" in diameter.

Millions of holes have been drilled with Penndrill bits, cutting job costs up to 60%.

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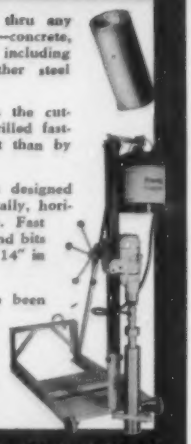

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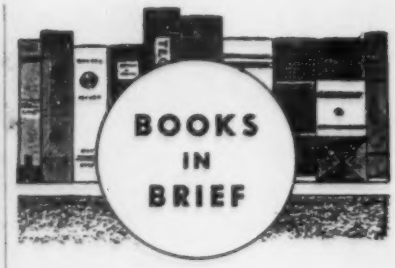


LEGISLATIVE PURPOSE IN HIGHWAY LAW

For the purpose of research analysis the Highway Laws Committee of the Highway Research Board has divided the field of highway law into a series of manageable segments, of which this study of legislative purpose in highway law constitutes one such element. This study deals with express legislative declarations of purpose concerning activities in the highway field. Special Report 39 is available from the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., and are $4 each.

GAMMA RAY MEASUREMENT OF PAVEMENT DENSITY

These two reports on measurement of surface density and bridge research were given at the 37th Annual Meeting of the Highway Research Board. The paper given by W. N. Carey, Jr., and John F. Reynolds is entitled "Some Refinements in Measurement of Surface Density by Gamma Ray Absorption." "Bridge Research at the AASHO Road Test" was given by Ivan M. Viest. Special Report 38 is available from the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C. at $1.20 per copy.

HONOLULU WATER SUPPLY REPORT

The Board of Water Supply of Honolulu, Hawaii, has issued its 17th biennial report and also a supplement to the report. The supplement is mainly statistical and financial. A great deal of useful information is presented in the 78-page statistical section on water use, rainfall, distribution system and water production costs and pumping data. The report itself is the usual beautiful job which summarizes the two-year activities. Edward J. Morgan is Manager and Chief Engineer.

PUBLIC HEALTH PESTICIDES

This is an annual release of the Communicable Disease Center, Public Health Service, Box 769, Savannah, Ga. It brings up to date current information on the use of pesticides for mosquito control in both larval and adult stages; for fly control using residual treatments, impregnated cords, poison baits and outdoor space sprays; and flea, roach, bedbug, tick, chigger and rodent control. Information on resistance to pesticides by the various insects is quite complete. This is an excellent publication of 12 large-sized pages. This report was published in the Pest Control Magazine for March, 1959.

STABILIZATION OF SOIL WITH CALCIUM CHLORIDE

This is a bibliography that presents a compilation of abstracts of the major portion of the literature on stabilization of soils with calcium chloride. An attempt was made to cover all phases of the field, from purely theoretical studies to maintenance practice. Copies of Bibliography 24 are available from Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., at $2 each.

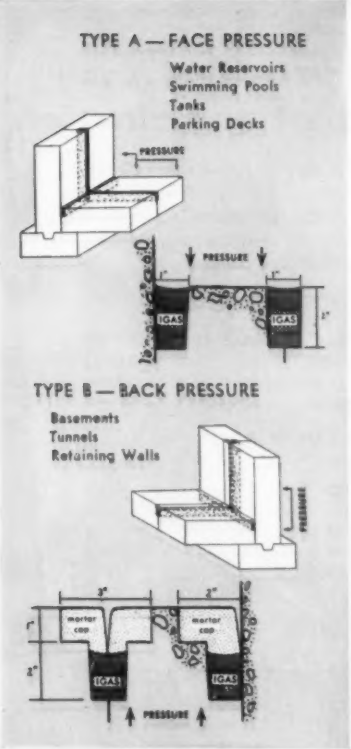
ENGINEERING ASPECTS OF GLACIAL SOILS

"Engineering Aspects of Glacial Soils of the Newark Metropolitan Area of New Jersey" presents briefly the geology and soil types associated with it in the general Newark metropolitan area, embracing Bergen, Essex, Hudson, Passaic, Union and part of Morris Counties. Some engineering aspects and practical applications of the soil survey are illustrated. The author is Professor Alfreds R. Jumikis, Rutgers University and copies of Bulletin No. 42 are available from the Bureau of Engineering Research, Rutgers—The State University, New Brunswick, N. J., and are $1.50 per copy.

BIBLIOGRAPHY ON MINERAL AGGREGATES

This 1958 revision includes and brings up to date the available data on mineral aggregates. It was compiled and annotated by J. F. McLaughlin, Purdue University. It comprises a chronologically arranged, annotated bibliography on mineral aggregates, including everything available up through 1956. Complete indexing both by subject and by author, makes for easy location of a specific reference. Copies of Bibliography 23 are available from the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., and are $2.20 each.

EFFECTIVELY SEALED



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Vertical, horizontal and overhead joints are effectively sealed with Igas . . . It is self-welding, forms a continuous watertight seal . . . Intersecting joints can be sealed easily . . . Igas is a tough, resilient and non-meltable black mastic compound, adhering to any construction material . . . It remains flexible over a wide temperature range — does not sag or flow in hot weather, nor become brittle in cold . . . It will not dry out, shrink or lose its effectiveness even after years of exposure . . . Igas is non-toxic and will not affect drinking water . . . It is resistant to sewage, salts, non-oxidizing acids, dilute acids and sea water . . . Write for bulletin IS-56. For detailed recommendations on sealing joints contact our Technical Service Department.

IGAS *is available in 4 consistencies to fit your job — pressure grade • knife grade • gun grade • extrusion grade . . . also available in gray color, in gun grade and knife grade.*

26-31

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COMPOUNDS FOR MASONRY and CONCRETE CONSTRUCTION

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Build a real future for your water department with the new

Read-o-Matic*

a REVOLUTIONARY product.... for a totally new method of reading

Now your water department can look to a future of increased efficiency and economy — through the Badger Read-o-Matic, industry's first *practical* outdoor register.

With this revolutionary new outdoor register, you'll play a major role in community progress . . . by providing consistently better water department operation and service to *every* customer . . . starting with these *immediate* benefits:

BOOSTS WATER DEPARTMENT NET REVENUE

Eliminated: meterman recalls, "read-it-yourself" cards, estimated water bills. Result: reduced reading costs . . . and greater savings because of simplified department accounting and operation.

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The Badger Read-o-Matic overcomes the chief problem of indoor reading: depending on the customer to be home. Instead, a meterman can complete his reading route in half the time it used to take by the old method — because the register is **outdoors** and always available.

BETTER SERVICE AND CUSTOMER GOOD WILL

Because the Badger Read-o-Matic is accessible to the meterman at all times, the customer will never be inconvenienced again. Your meter records are always up to date; the customer's meter bills will always be accurate.

*Patents applied for in U. S. A. and foreign countries.

Dynamic New Idea!

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Glamorous *Mayfair,* Milwaukee, marks a new trend in ultra-modern suburban shopping centers. Its *metering system* — trend-setting, too.

A network of Badger Read-o-Matic registers serves Mayfair's more than 85 stores. Meters are located in the stores . . . connected to a central Read-o-Matic reading station for each section as shown in color on the aerial view (right). A typical panel of Read-o-Matic registers at Mayfair is shown below.

Meter reading — just a few minutes' work. And the Read-o-Matic registers are always accessible.

. . . Another in Badger Meter's big parade of new products for better water metering

Key to the Badger Read-o-Matic register — a self-powered generator that requires no outside source of power. It originates its own pulses that are recorded on the outdoor register. The register can be placed as far as one-half mile from the meter itself.

This revolutionary meter-register is another product of Badger's research devoted *exclusively* to the continuous improvement of water meter design, construction and performance.

Write us today. We'll send a free, colorful brochure with full details about the new Badger Read-o-Matic outdoor register.

Badger Water Meters

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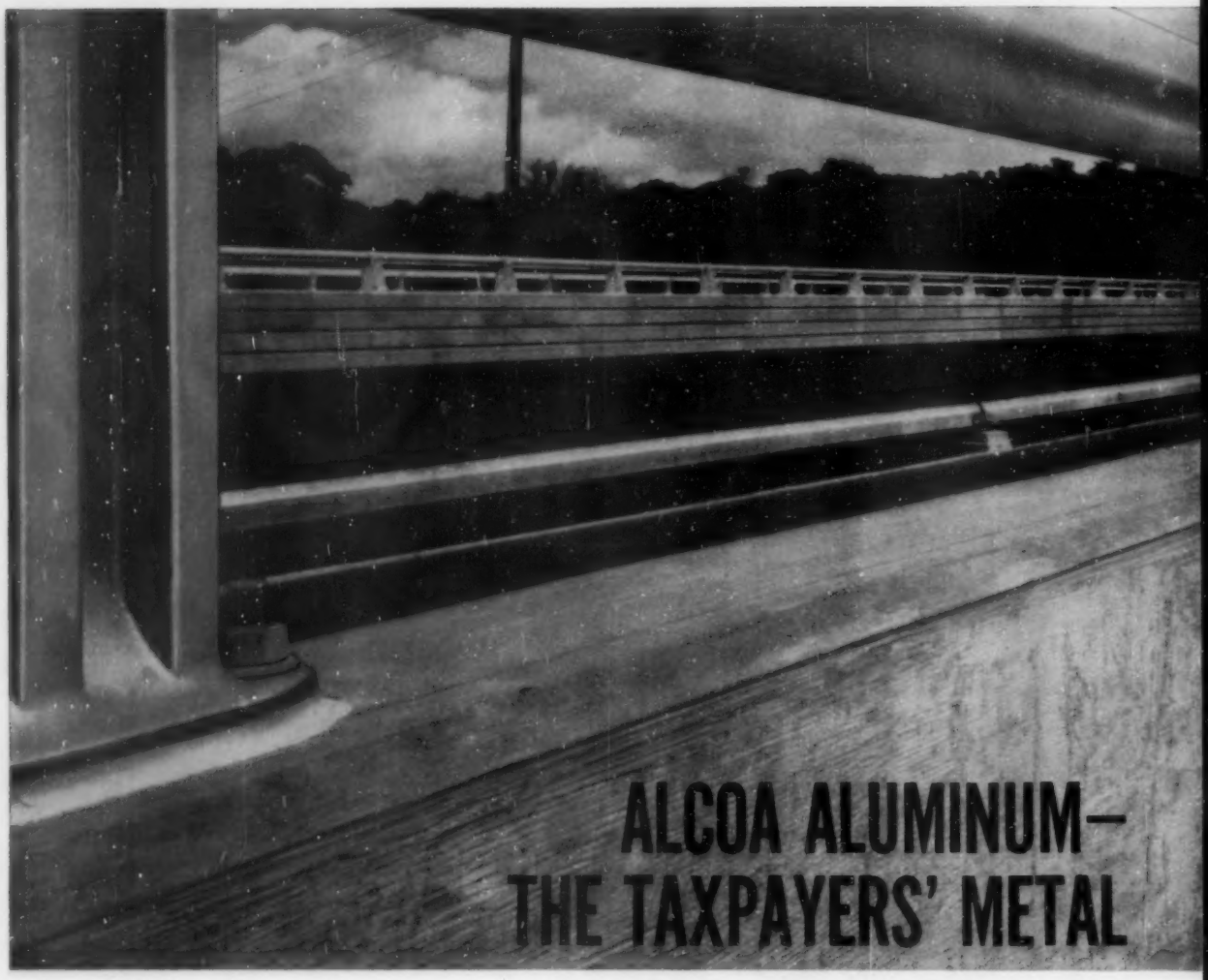
OFFICES IN PRINCIPAL CITIES



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Alcoa® Aluminum is the taxpayers' metal. Light, strong and corrosion resistant, it makes highway dollars yield greater value in bridge railings, guard rail, lighting standards, fencing and highway signs. The reason is simple: first cost is last cost. Alcoa Aluminum's lightness assures faster, less expensive installation. Its defiance of moisture, road salts and corrosive fumes eliminates costly painting. Alcoa jobber-erectors and Alcoa's own technical experts can prove that you'll move more traffic at lower cost with highway products of Alcoa Aluminum. Your first step: write today to Aluminum Company of America, 1912-G Alcoa Building, Pittsburgh 19, Pennsylvania.

◀ **Alcoa Aluminum Beam Guard Rail** combines minimum upkeep with maximum protection. Impervious to the corrosive inroads of road salts, industrial fumes or air-borne grit, Alcoa Aluminum Beam Guard Rail never needs painting. An added safety factor is its increased energy-absorptive capacity gained from high-strength aluminum alloys. And Alcoa Aluminum Beam Guard Rail is available with aluminum posts, too, to round out the low-maintenance, high-safety story. Initial cost, only slightly higher than ordinary guard rail, is quickly saved.

◀ **Alcoa Aluminum Chain Link Fence** never needs painting. Here, again, first cost is last cost. Once Alcoa Aluminum Chain Link Fence is installed—on a highway as a divider strip or along a right of way, for instance—it never needs another penny's worth of maintenance. It is strong (minimum tensile strength: 54,000 psi), light and readily obtainable from Alcoa's nationwide network of jobber-erectors. It saves initial costs because installation is faster and easier, then keeps on saving money over the years because of its maintenance-free features.

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For Exciting Drama Watch "Alcoa Theatre," Alternate Mondays, NBC-TV, and "Alcoa Presents," Every Tuesday, ABC-TV

Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

Inside Coating for Metal, Concrete or Tile Pipe

21. Shell Epon 1001 is an ideal interior pipeline coating for potable water lines. It may be applied by brush, spray and pig and setting takes place in an hour. Literature available from Shell Chemical Corp., Plastics and Resins Div., 50 West 50th St., New York 20, N. Y., or by checking the reply card.

Manual on the Handling, Storing and Applying of Calcium Chloride

22. Written especially for highway engineers and contractors, this illustrated Manual provides data on approved methods for handling, storing and applying calcium chloride. There is also a special section that includes winter maintenance data. For your copy of Manual HM-1 check the reply card or write the Calcium Chloride Institute, 909 Ring Building, Washington 6, D. C., today.

Wherever Water Flows, Steel Pipes It Best

26. Complete data on the use of steel pipe for water supplies are available from Steel Plate Fabricators Association, 105 West Madison St., Chicago 2, Ill. Check the reply card today.

What You Should Know About Refuse Incinerators

30. Two helpful bulletins tell what you should know about low cost refuse incineration for the small community and for larger cities. Your questions on mechanical stoking, burning rates and operating problems are discussed. Get Bulletins 217A and 223A from Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y. Just check the reply card.

Steel and Aluminum Lighting Standards

34. Street and highway lighting standards, floodlighting standards, traffic signal standards and arms, strain poles, brackets and mast arms and accessories are some of the units described in catalog from Kerrigan Iron Works, Inc., P. O. Box 479, Nashville 2, Tenn.

Penetrant Test Kit Finds Cracks, Pores and Leaks in Solids

35. The Zyglo portable kit provides the most convenient and sensitive means for on-the-spot and in-place leak tests on tanks, lines, fittings and castings. Check the reply card or write Magnaflux Corp., 7303 West Ainslie Ave., Chicago 31, Ill.

Gyro-Flo 125-cfm Portable Rotary Compressor

44. Compressor is powered by either a gasoline or diesel engine and is available with 2-wheel mounting or less running-gear for truck or skid mounting. Specifications and models are covered in bulletin from Ingersoll-Rand, 11 Broadway, New York 4, N. Y. Check the reply card.

Complete Line of AC and DC Standard Motors and Speed Drives

55. Bulletin No. 2650 gives data on motors and drives for power plants, pumps and other public works applications. For a summarization of the characteristics and modifications for 20 basic types of motors and drives check the reply card or write The Louis Allis Co., Milwaukee 1, Wis.

MORE LISTINGS ON PAGES 36 TO 56

Catalogs on Steel Piling

66. Two catalogs, one describing sheet steel piling for cofferdams and retaining walls, the other describing H-piles for bridge and building foundations are available from Bethlehem Steel Co., Bethlehem, Pa. Check the reply card.

Caterpillar Engines for Many Uses

74. Four-cycle diesels from 75 to 650 hp and electric sets from 30 to 350 KW are described in literature from Engine Div., Caterpillar Tractor Co., Peoria, Ill. Check the reply card.

Data on Proper Grouting Practices

78. Describing successful grouting techniques with Embeco non-shrink grout, Bulletin Eld outlines and illustrates common methods of grouting different types of equipment, the mixing and placing of grout and cold and hot weather grouting. Check the reply card or write The Master Builders Co., Cleveland 3, O.

Soil Compaction by Vibroflotation

85. The application and the operation of soil compaction by Vibroflotation are covered in literature from Vibroflotation Foundation Co., 930 Fort Duquesne Blvd. Pittsburgh 22, Pa. Check the reply card for soil consolidation examples and technical data and specifications.

Manual Available on Electro-Channel Steel Joists

92. Joists, which incorporate a built-in duct for underfloor wiring, are described in a 28-page manual available from Ceco Steel Products Corp., 5601 West 26 St., Chicago 50, Ill. Check the reply card.

Catalog on Excavator-Crane for All Types of Construction

94. A 20-page, two-color catalog with photos and descriptive data on Insley 1½ cu. yd. excavator, 30-ton crawler crane and 35-ton rubber mounted crane is available by checking the reply card or writing Insley Mfg. Corp., P. O. Box 167, Indianapolis, Ind.

Telemetering Links Transmitter and Receiver Over Any Distance

102. Bulletin #230-P4 describes how Builders-Providence Chronoflo telemeters enable users to observe and record the operation of widely scattered meters at a central location from any distance. Check the reply card or write B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I .

Welded Steel Pipe, Steel Piling and Corrugated Metal Culvert Pipe

103. Catalog on continuous electric welded steel pipe, cement mortar lined and coated pipe, coal tar lined and wrapped pipe, water well casings and corrugated culvert pipe is available from Southern Pipe & Casing Co., A Division of U. S. Industries, Inc., P. O. Box C, Azusa, Calif. Check the reply card.

Complete Line of Water Treatment Equipment

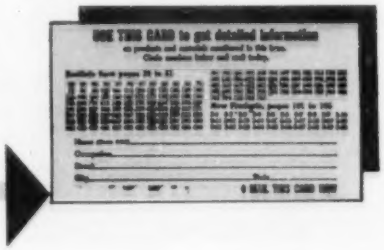
108. Eimco-Process development which combines coagulation and flocculation, sedimentation and sludge removal in a single unit is described in catalog from Process Engineers, Inc., Div. of the Eimco Corp., 420 Peninsular Ave., San Mateo, Calif. Check the reply card.

Silicones for Water Repellents for Masonry

128. An 8-page catalog from the Silicone Products Dept., General Electric Co., Waterford, N. Y., describes silicones and lists their uses. Check the reply card.

Complete Line of Gear and Fluid Drives Combined in One Book

130. The most extensive line of standardized gearmotors, motogears and fluid drives available has been combined into a 48-page catalog available from Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill. Check the reply card.



Don't run short of salt when demand is heaviest

Order enough Morton Rock Salt now

Be prepared before unexpected storms ice your streets and highways. Eliminate confusion, extra work and accidents by stockpiling Morton Rock Salt now for winter ice and snow removal. Store it in unused buildings, garages, loading platforms or outdoors near key traffic points. You can do this without loss or inconvenience—and, if you wish, a Morton Consulting Engineer will be happy to advise you.

Morton Rock Salt is 8 times better than abrasives. One man and one truckload of Morton Rock Salt does a better job of ice and snow removal than 8 men and 8 loads of abrasives. Morton Rock Salt leaves no messy residue on streets, in gutters and sewers . . . needs no flushing after a thaw . . . won't blow away or leave a rutted, dirty pavement. Non-toxic, Morton Rock Salt also is inexpensive. (It generally costs far less than calcium chloride.)

Send for more information today! Fill in and mail coupon below for valuable help with ice and snow removal.

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MORTON SALT COMPANY

INDUSTRIAL DIVISION

Dept. PW7, 110 N. Wacker Drive
Chicago 6, Illinois

To order these helpful booklets check the reply card opposite page 36.

NEW LISTINGS (Cont.)

Soil Sampling Equipment for Dams, Bridges, Highways and Airports

142. Bulletin 300, available from Sprague & Henwood, Inc., Scranton 2, Pa., illustrates and describes their complete line of soil sampling equipment and their Model PD & PDH soil sampling rigs. Check the reply card for data on sampling equipment.

Aerial Platform for Street Lamp Replacement and Cleaning

189. A Strato-Tower series, Model "SL" designed and engineered specifically for use in globe cleaning and street lamp replacement is covered in literature by Strato-Tower Div., Young Spring & Wire Corp., P. O. Box 103 Elkhart, Ind. Check the reply card.

Specification Manual on the Hapman Tubular Conveyors

187. How to specify Hapman tubular conveyors for use with grit and filter cake including storage hopper, supporting structure and freeze-up protection are contents of this manual. For your copy check the reply card or write Stuart Corp., 516 North Charles St., Baltimore 1, Md.

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletin W-200 explains how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card for full details.

Literature Describes M-B Contain-O-Pack System

190. A 6-page catalog describing the M-B Contain-O-Pack, a complete low cost containerized refuse system for private haulers and municipalities is available from M-B Corp., New Holstein, Wisc. Check the reply card.

Bulk Refuse Collection with Super Roto-Can

192. A bulletin describing the bulk refuse system called the City Tank Roto-Can, which provides an unusual flexibility of service and the handling of all types of trash, is available from City Tank Corp., Corona, N. Y. Check the reply card.

International Wagner Heavy-Duty Loaders and Backhoes

195. International Wagner loaders and backhoes are matched with International utility tractors and are described in Catalog CR-1076-I available from International Harvester Co., Consumer Relations Dept., 180 N. Michigan Ave., Chicago 1, Ill. Check the reply card.

Cast Iron Fittings For All Types of Water Pipe

203. Short body and mechanical joint water-main fittings—2" through 12", standard bell spigot fittings—2" through 36", ring-tite fittings—3" through 12" and fluid-tite fittings—3" through 12" are covered in literature from Trinity Valley Iron and Steel Co., P. O. Box 664, Fort Worth, Texas.

Traffic Protection with AmBridge Highway Beam Guard Rail and Posts

205. USS AmBridge beam guard rail can be furnished in 25-ft. lengths and with the steel posts make a strong, highly visible and economical guard rail. Check the reply card or write American Bridge, Division of United States Steel, Pittsburgh, Pa.

1½ Cu. Yd. Tractor Shovel for Standout Performance

208. The Trojan 124 has 10,000 lb. rated lifting capacity, power shift transmission and 40" bucket tip at carry position. For literature write to Trojan Div., The Yale & Towne Mfg. Co., Batavia, New York, or check the reply card.

Microstraining, Automatic Water Filtration

210. Glenfield Microstrainer provides high filtration, efficiency, automatic and continuous operation under open gravity conditions and small head loss. For literature check the reply card or write Glenfield & Kennedy, Inc., 706 North Ave., New Rochelle, N. Y.

Spiraflo Clarifiers for Water and Waste Treatment

216. 32-page Bulletin 126 available from Lakeside Engineering Corp., 222 West Adams St., Chicago 6, Ill., covers performance and design data on the efficient Spiraflo Clarifier. Check the reply card.

Clamps for Pipe and Hose and Steel Straps

219. Literature is available from Marman Div. Aeroquip Corp., Industrial Sales Div., 11214 Exposition Blvd., Los Angeles, Calif., on clamps to stop leaks on low and high pressure pipe, band clamps for hose, duct, pipe strap hanger and mounting bracket and stainless steel flags for identification purposes. Check the reply card.

Fibre Pipe For Sewer Lines and Septic Tank Connections

232. Bermico bituminized fibre pipe is lightweight, rootproof and easy-to-install. Check the reply card or write Brown Co., 150 Causeway St., Boston 14 Mass., for full details.

Chemical for Roadside Weed Maintenance

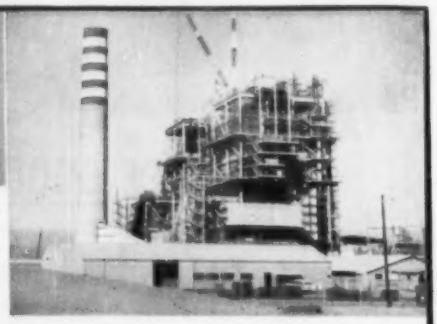
234. Garlon is an easy to prepare and to use chemical in the control of roadside weeds and growth. For complete data write The Dow Chemical Co., Agricultural Chemicals Sales, Midland, Mich., or check the reply card.

If You are Considering a Bond Issue Check with Chase Manhattan

236. For details on bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 40 Wall St., New York 15, N. Y. Check the reply card.

FOR UTILITIES and GOVERNMENT AGENCIES

DE-WATERING PROBLEMS LICKED with FLYGT Submersible Electric Pumps



Near Los Angeles, California, the immense Steam Generating Plant illustrated above produces more electricity than Hoover Dam, and when completed it will be one of the major sources of electric power in the entire West. This plant uses two FLYGT models B-80 and one B-38L for a variety of around-the-clock de-watering applications. Operating at the bottoms of sumps and excavations, the FLYGT PUMPS keep strategic areas free of salt-water intrusion and seepage from storm water run off. The FLYGTs often pump a high proportion of solids, and have proven resistant to salt water.

Public Utilities and Government Agencies throughout the world find FLYGT SUBMERSIBLE ELECTRIC PUMPS tops in performance on any de-watering problem. Public Works users like FLYGT foolproof features, the advantage that the pumps work in any position, and the fact that they do not clog up. They can take a lot of solid stuff like mud and sand without hurting them in any way. The rubberized pump casings and hard chrome alloy impellers combine to make FLYGT PUMPS rugged equipment which works 24 hours a day with little or no attention. Low in initial cost . . . low in operating expense, FLYGT PUMPS will save you money.

FLYGT SUBMERSIBLE ELECTRIC PUMPS range in size from 1½"-85 GPM capacity to 8"-3000 GPM capacity. Head capacities range up to 210 feet. Higher heads obtainable with FLYGT PUMPS in tandem. Weights range from 70 to 1200 pounds. Write for complete specifications.

CHECK THESE FLYGT FEATURES

- Electric, fully submersible, fully portable.
- Instant pumping — no priming, no installation.
- Runs dry without damage, resistant to salt water.
- Takes a high proportion of solids, frost and fire-proof.
- Practically no maintenance or supervision.
- Operates unattended, quick and easy to service.

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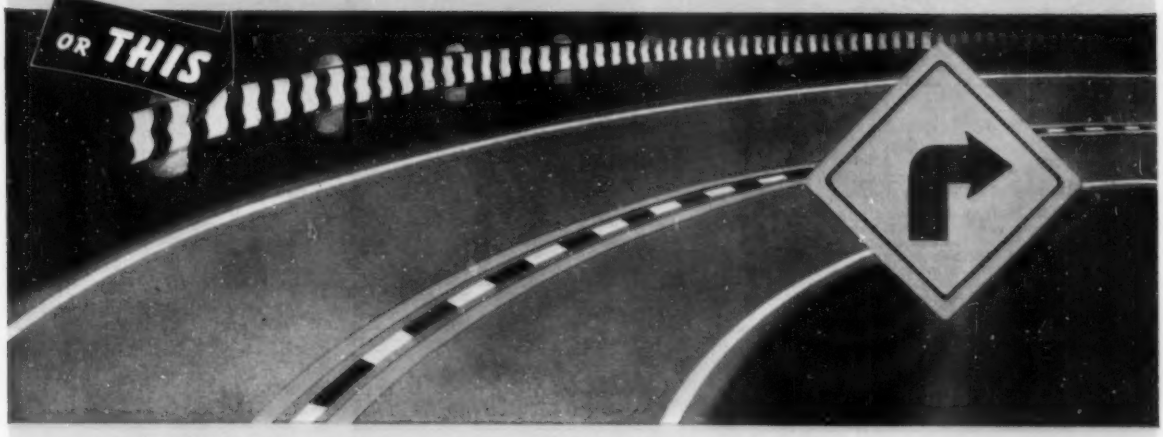
WEST OF THE MISSISSIPPI: Stanco MFGR. & SALES INC. 1666 Ninth St. (Corner of Olympic & Ninth) Santa Monica, California.

EAST OF THE MISSISSIPPI: STENBERG MANUFACTURING CORPORATION Hoosick Falls, N.Y.

DO YOUR TRAFFIC SIGNS LOOK LIKE...



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LEAD-FREE REFLECTIVE GLASS BEADS COULD MEAN THE DIFFERENCE

Signs employing the finest reflective materials are adversely affected in a number of ways, such as by moisture, thermal changes and dirt . . . as well as acts of vandalism, accidental breakage and normal wear and tear. Further, the sulphides in industrial fumes attack glass beads containing lead, causing them to turn dark, with a consequent loss of their reflectiveness and visibility. Maintaining adequate visibility through fair weather and foul for maximum safety is a *must*. To ignore this fact is bargaining with lives. So, it is just common sense to buy lead-free beads that won't turn dark. That's why street and highway engineers specify Flex-O-Lite Lead-Free Reflective Glass Beads —with full confidence in their maximum brilliance and lasting reflectivity throughout a longer life. Specify the beads proved best by test. Insist on Flex-O-Lite Lead-Free Reflective Glass Beads. Write for free, informative brochure.

- **#831 REFLECTIVE GLASS BEADS**—Best for white and yellow signs. Meet and exceed all test requirements . . . micro-scopic, acid, sodium sulphide, spherical content, gradation.
- **FREE-FLOWING REFLECTIVE GLASS BEADS**—Won't agglomerate. Contain no injurious waxes, oils or resins. Offer perfect adhesion to any suitable traffic bead binder. Economical.
- **TYPE H SAFETY SPHERES**—Approximately fifteen times brighter than standard highway beads. For reflectorizing guard rails, curves, bridge abutments, safety islands, etc. Offer maximum reflectivity at lowest cost.
- **FLEX-O-LITE FREE-FLOWING TRAFFIC LINE BEAD DISPENSER**—New, simplified. Affords years of trouble-free operation. Ideal for municipal and highway use. Attaches to any traffic line paint machine. Satisfaction guaranteed.
- Ask about our Sign Bead Applicator.

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8301 FLEX-O-LITE DRIVE • P. O. BOX 3066 (AFFTON BRANCH) • ST. LOUIS 23, MO.

To order these helpful booklets check the reply card opposite page 36.

WATER WORKS

In-Place Cement Lining of Small and Large Pipe

25. A catalog describing a process of in-place centrifugal cement lining of pipes from 4 to 144 ins. in diameter is available from the Centriline Corp., Raymond International Inc., 140 Cedar St., New York 6, N. Y. Check the reply card for sample specifications and test results.

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Meter Features That Help Make Water Works Profitable

89. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American Water meters described in Bulletin No. 56 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Check the reply card.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Propeller Meters For Dependable Water Metering Control

53. The complete line of Measure-Rite propeller meters are described in Bulletin MR-105 available from Measure-Rite, Inc., 4545 W. Brown Deer Rd., Milwaukee 18, Wis. Check the reply card for full details on these accurate meters.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

Complete Specifications on Smith Hydrants

89. Smith frost-proof fire hydrants that conform to AWWA specifications with 4, 4½, 4½, 5 and 6-in. valve openings for water working pressures up to 150 lbs. and hydrants for intermediate and high pressure services up to 300 lbs. are covered in catalog from the A. P. Smith Mfg. Co., East Orange, N. J. Check the reply card for this valuable catalog on hydrants for municipalities.

Right Angle Gear Drive and Deep Well Turbine Pump

107. Applications, gear drive selection tables, pulley data, efficiencies and standard dimensions of Johnson right angle gear drives are covered in catalog from Johnson Gear & Mfg. Co., Ltd., Eighth and Parker Sts., Berkeley 10, Calif. Check the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp, Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

Protecting Water Lines Against Overpressures

126. Overpressures can be eliminated in water systems by the use of the Surge relief valve described in Bulletin W-2-A from the Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Check the reply card for complete engineering information, detailed drawings and suggested specifications.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestesaed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

Manual on Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

BAUGHMAN SAND and CINDER SPREADER

SAFETY CHAMPION FOR STREETS AND HIGHWAYS
choice of 4 drives

PTO with { Mechanical Operation / Hydraulic Operation | Auxiliary Engine with { Mechanical Operation / Hydraulic Operation

CAB CONTROLLED VACUUM CLUTCH PERMITS SPOT SPREADING (on mechanical operation)

Completely sealed, vacuum operation, controlled from cab. Start or stop spread in motion, as at intersections, safety zones. On hydraulic operation models, spot spreading is controlled by by-pass valve.

TWO-SPEED "QUICK CHANGE" MECHANISM

Simple sprocket and chain drive: low for chemical spreading, high for large-volume spreading. No need for expensive automotive transmission. On hydraulic opetation models, spreading volume is valve controlled.

MODEL K5-SC

Better service through better engineering

WRITE FOR NEW ICE CONTROL CATALOG!

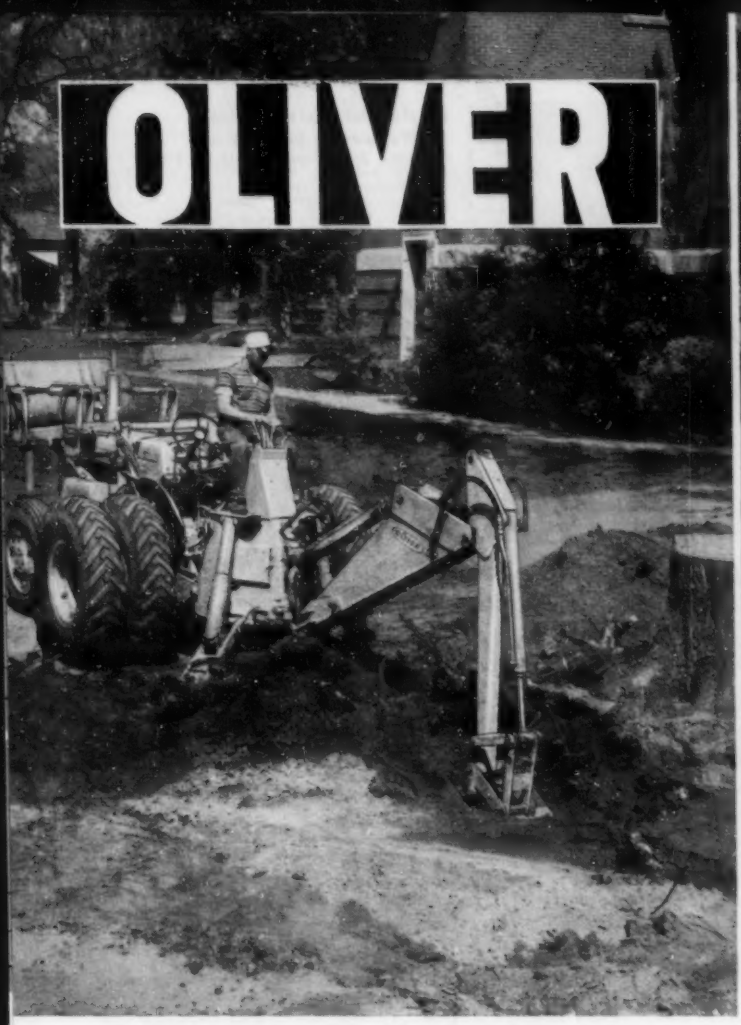
Service and parts from 200 service branches

BAUGHMAN

BAUGHMAN MANUFACTURING COMPANY

221 SHIPMAN ROAD JERSEYVILLE, ILL.

OLIVER



JUST SECONDS SEPARATE THESE PICTURES!

With dig-and-dump speed like this, figure the *extra* income that's yours from a rapid-cycling Oliver 770 tractor with No. 70 backhoe and 778 loader!

Whether you are grubbing out heavy-rooted stumps as here...doing production trenching...or handling 101 other backhoe jobs, you capitalize on more modern tractor design with highest engine and hydraulic power to get stepped-up job production.

Note the easy job *this* operator has of it—how all controls are conveniently in hand, *in his lap*. No time-wasting long reaches; operation is finger-tip simple, the *nontiring* Oliver way.

Oliver gives you three great new wheel tractor models —each a master for easy mobility, exceptionally wide work scope and *all* the advantages that put more job contracts into your pocket!

Job-Test These Olivers Now!

NEW OLIVER 550—an all-purpose, versatile, budget-priced tractor of high-income ability. Gas or diesel. 558 loader capacity is 12 cu. ft....works with all mounted equipment, 70 backhoe and 3-point hitch tools.

OLIVER 770—a top-speed performer in its popular-size class; today's biggest value. Mounts ¾-yd. loader; is available with "Reverse-O-Torc" instant, finger-tip reversing; backhoe buckets from 12" to 36". Gas or diesel.

OLIVER 880—the big-production, heavy-duty loader or backhoe. Loads ultrafast with 1-cu.-yd. loader and "Reverse-O-Torc" control. Backhoe gives you fast, deep digging just like the big rigs at a fraction of the price! Gas or diesel.

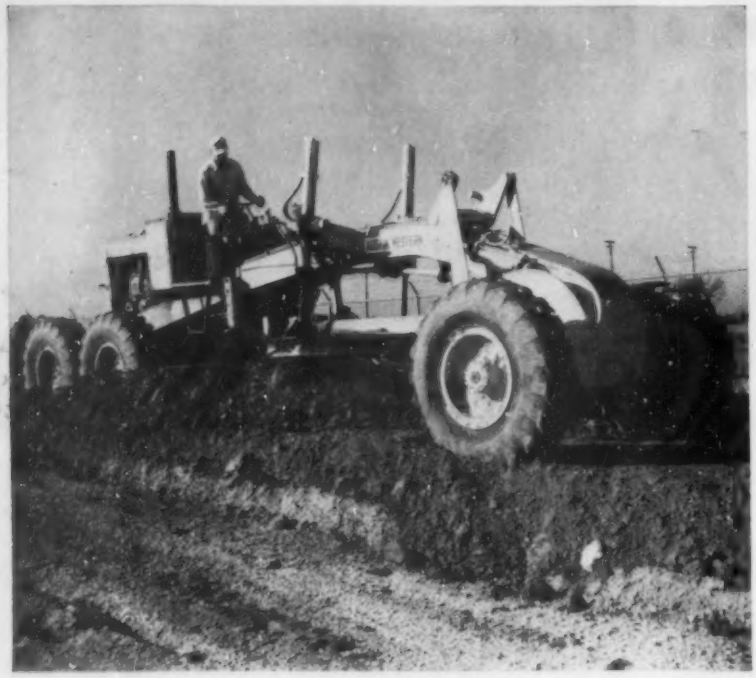
THE OLIVER CORPORATION
Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio
a complete line of industrial wheel and crawler tractors and matched allied equipment

TELL ME MORE...give me full details on the Oliver model I have checked:
☐ Oliver 550 ☐ Oliver 770 ☐ Oliver 880
☐ I want a job demonstration, please.

Name..... *Position*.....

Address..... *City*..... *Zone*..... *State*.....

To order these helpful booklets check the reply card opposite page 36.



Powerful Austin-Western Super 300 Grader moves more dirt—and moves it farther and faster—with fully loaded blade because of exclusive A-W all-wheel drive and steer.

Michigan County Road Commissioner says:

"Bet your boots . . . next grader will be another Austin-Western!"

The Austin-Western 6-wheel power grader can do everything any other grader can do, and then some! It has the greatest maneuverability of any motor grader on the market." That is what Heath P. Calvin, of Berrien County (Mich.) Road Commission, says about Austin-Westerns.

Versatile A-W outperforms

The Commission is responsible for maintenance of 1300 miles of roads. Because of its versatility, the grader is loaned back and forth between two county highway construction crews to accomplish the difficult jobs that other machines cannot perform.

Snow removal is a real problem in Michigan. Mr. Calvin says, "The Austin-Western is the only grader which can be equipped with a wing plow to really shove a snowbank to one side. Rear wheel steering allows you to ease the A-W into the bank and not skid out like other graders.

"We bought the A-W new in 1956. Routine maintenance has been extremely low, considering the amount and variety of work we've been doing with the Austin-Western. No major repairs.

"You can bet your boots that the next grader we buy will be another Austin-Western!"

New expanded A-W grader line

Austin-Western now offers two entirely new and expanded grader lines—6-wheel Supers and 4-wheel Pacers in the 100, 200 and 300 Series . . . power ranges from 106 to 120 hp—weight classes from 16,000 to 22,850-lb.

See the completely new Austin-Western Supers and Pacers at your A-W distributor's now . . . or write us direct for full information on these expanded and improved lines of advanced design power graders!

Austin 100th YEAR **Western**

CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.

BALDWIN · LIMA · HAMILTON

Power graders • Motor sweepers • Road rollers • Hydraulic cranes

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

Outline of Modern Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Department, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin BW-13 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

Waterworks and Municipal Castings

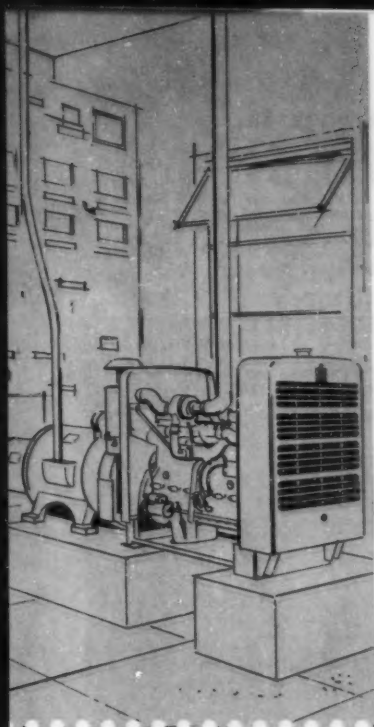
293. Meter boxes and covers, yokes and couplings, service boxes and manhole covers are covered in 24-page catalog. Check the reply card or write H. W. Clark Co., Mattoon, Ill., for full specifications.

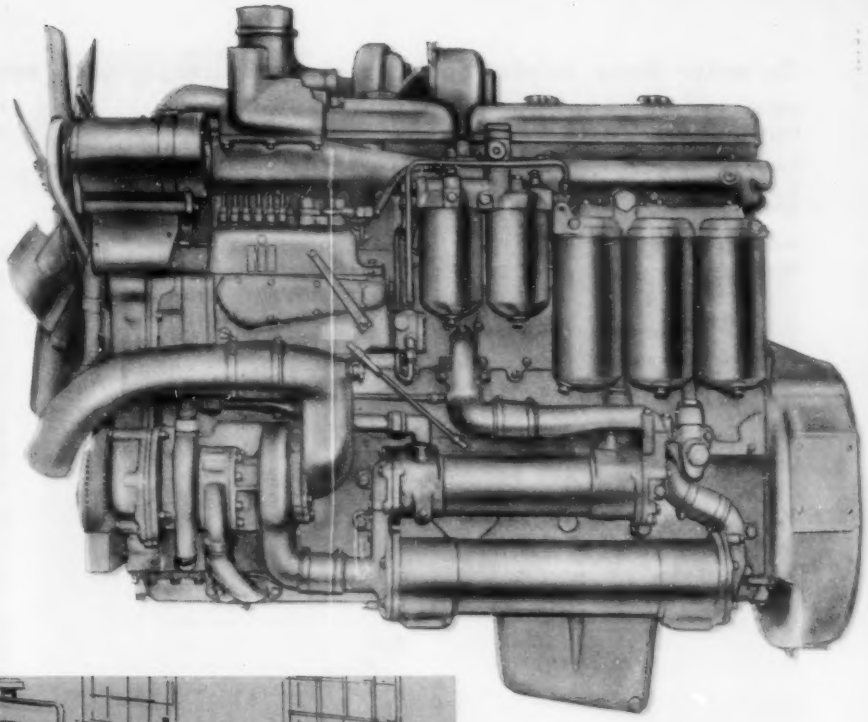
Quick Review of Water Meters

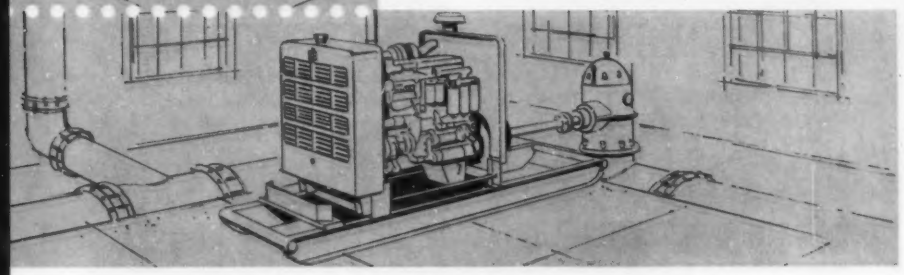
316. A helpful condensed catalog which covers sizes and types of water meters for every kind of service is available from Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. Each type is illustrated and fully described; specifications and prices are included. Get Bulletin W-800 by checking the reply card.

Renew Pipe Performance With Cement Mortar Lining

322. Application of the Tate and Spunline process for cement mortar lining of existing pipe lines with a minimum of interruption of service is described, with diagrams, photographs and specifications in Catalog 15-58. Write to Pipe Linings, Div. of American Pipe and Construction Co., P. O. Box 457, Wilmington, Calif., or check the reply card.







NEW UDT-817 DIESEL is a 4-cycle turbocharged engine with 817 cu. in. displacement and max. torque of 1,040 lbs. ft. @ 1,400 rpm.

New power, performance and price leader in the 385-hp diesel class

Here are three fast facts about the turbocharged new direct-start, direct-injection International 6-cylinder UDT-817 diesel that can mean big savings on your standby generator and pump power:

POWER—The UDT-817, developing 385 hp., leads the field in its size class.

PERFORMANCE—The specific fuel consumption of the UDT-817 is the lowest in its size class.

PRICE—The UDT-817 is the lowest priced engine in its size class in dollars per horsepower.

A wide variety of accessory equipment including air cleaners, flywheels for leading makes of torque converters and clutches, torque converter cooler, air control compressors, safety shut-offs, instruments and engine controls can be furnished to meet your installation requirements. Base, radiator, hood and dash, clutch and power take-off are available for complete power units.

The new 250-hp. D-817 is the naturally aspirated version of this same basic diesel engine. Your nearby International Power Unit Distributor or Dealer can give you full details of either new model or on the 30 other diesel and carbureted engines in his line. All 32 engines have one common feature—fastest payback power for users.

International® *Construction Equipment*

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

To order these helpful booklets check the reply card opposite page 36.

Manual on the Hersey Disc Water Meter

339. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-⅝"x¾"-¾" and 1". Check the reply card.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 18, Wisconsin.

Modern, Welded Constructed Elevated Steel Tanks

382. Revised edition of Horton ellipsoidal elevated steel tanks of welded construction is available from Chicago Bridge & Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. The catalog is well illustrated and contains a table of standard tank dimensions for capacities ranging from 40,000 to 500,000 gals.

Diesel-Electric Power Plant on Wheels

476. Uninterrupted power under emergency conditions can be assured by trailer units assembled with diesel engine and electric generator. For full details write A. G. Schoonmaker Co., Inc., Foot of Spring St., Sausalito, Calif., or check the reply card.

Submersible Pumps for Municipal Water Supply

478. Submersible pumps from 3 through 125 hp in speeds of 3550 and 1750 rpm are described and illustrated in Bulletin B1200 available from Sumo Pumps, Inc., 23 Brown House Road, Stamford, Conn. Check the reply card.

International 6-Cylinder Carbureted Power Units

398. A graphically-illustrated 12-page catalog CR-511-G, on IHC 6 new 6-cylinder power units is available. Power and fuel consumption curves and cutaway views of component parts of the units are covered. Check the reply card or write Construction Equipment Div., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., for specifications.

How to Eliminate Seepage On Construction Projects

472. Labyrinth waterstops are easily installed to provide the answer to the seepage problem and simply form work on all types of construction jobs. Investigate their use for water and sewage plants, reservoirs, swimming pools, etc. For full data check the coupon or write to Water Seals, Inc., 9 So. Clinton St., Chicago 6, Ill.

Butterfly Valves For Water and Sewage Treatment Plants

507. Rubber seated butterfly valves are described and illustrated in a new two-color Bulletin No. 5603, available from F. B. Leopold Co., Inc., 227 So. Division St., Zelienople, Pa. Complete details on the performance and construction features of the valve are included.

Residual Chlorine Recorders For Water Plants and Swimming Pools

508. An instrument for measuring residual chlorine amperometrically in a continuous sample and recording the reading in parts per million on a 24 hour circular chart is described fully in literature available from Wallace & Tiernan Inc., Box 178, Newark, N. J.

Sparling Broad Gauge Compound Meters

666. All flows registered on one totalizer is the feature on the Sparling meter. Write Sparling Meter Co., 225 N. Temple City Blvd., El Monte, Calif., or check the reply card for Bulletin No. CF 333-1 that describes this unit.

Floatless Liquid Level Controls

513. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

Data on Standard Storage Tanks

594. Graver's informative bulletin on the many uses of standard cone-roof tanks presents the many applications and includes tables of sizes, capacities, specifications and accessories. Check the reply card or write Graver Tank & Mfg. Co., Division Union Tank Car Co., East Chicago, Ind.

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Manual on Valves, Fire Hydrants and Accessories

670. Complete line of Iowa valves and hydrants are covered in this manual from Iowa Valve Co., Oskaloosa, Iowa. All equipment meets AWWA specifications.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Genuine Blaw-Knox repair parts are the best way to extend service life

Your Blaw-Knox Clamshell Bucket was designed and built as a complete unit to give you the most efficient operation, low maintenance and long life.

Mongrel repair parts cut into your profits by cutting operating efficiency and functional ability. Your Blaw-Knox bucket engineer will be glad to advise you on the proper replacement parts. Call him today.

PARTS IDENTIFICATION SHEETS. Send us the size and serial number of your Blaw-Knox Bucket. We'll be happy to send you the correct parts identification sheet.

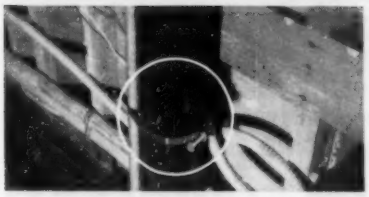
BLAW-KNOX COMPANY
Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

BLAW-KNOX

Versatile MARMAN Combination

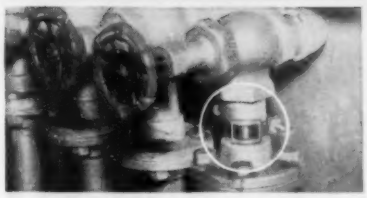
SOLVES MAINTENANCE PROBLEMS

MARMAN UNIVERSAL BAND CLAMP FITS TIGHT, STAYS TIGHT



It adjusts to any diameter, any shape; withstands sustained vibration. Fastens quickly with thumb screw for permanent installation or temporary use. Corrosion resistant band of stainless steel. Four band lengths fit all diameters from ¼" to 16½".

. . . ADD A PATCH TO REPAIR PIPE LEAKS



Slide a Marman pipe leak patch on the Universal Band Clamp to make a Marman PATCHMASTER* Clamp. Synthetic rubber patch conforms to pipe shape, holds pressures up to 800 psi., won't collapse weak pipe. Fits sizes up to 9⅛" diameter.

. . . OR, ADD A FLAG TO IDENTIFY AND INSTRUCT

Eliminate mistakes and delays by identifying lines and equipment with the Marman FLAGMASTER*. Put message on 2" x 4" flag, slide flag on Universal Band Clamp and attach to any pipe, pole or stand from 2⅝" to 16" in diameter.

*FLAGMASTER and PATCHMASTER are Aeroquip Trademarks

Order This Versatile Band Clamp Combination Today Through These Distributors:

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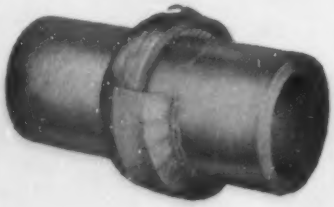
MARMAN DIVISION
Aeroquip Corporation

Industrial Sales Department, 11214 Exposition Blvd., Los Angeles, California

To order these helpful booklets check the reply card opposite page 36.

BUILD BETTER SEWER LINES



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GASKETS and FORMS

for

SEWER PIPE JOINTS

(a cement joint)

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON CO.

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(FLUOSILICATE)

We would like the opportunity to bid on your future requirements—

Please mail invitations to bid to—

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SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Buckets and Grapples For Incinerator Service

110. Bulletin provides comprehensive information on the 5 sizes of 2-line, lever arm, clamshell-type buckets; standard 2-line, tine-type grapples; equalizer arrangements and certain incinerator buckets for single drum hoists. Check the reply card or write Blaw-Knox Co., 300 Sixth Ave., Pittsburgh, Pa., today.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Flush Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Manual on Sewer Structures

178. This is a 48-page manual on installation design, reference data and graphs showing discharge of pipe based on Manning's formulas. Also such subjects as structural durability, material durability; selection of structures; factors influencing capacity; joints and fittings; and linings for failing sewers are covered. Copies of Manual CMS-7456 are available from the Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio, or by checking the reply card.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holiday and Saratoga Sts., Baltimore 2, Md.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1132 W. Blackhawk St., Chicago 22, Illinois.

Positive Screenings Removal With Front Cleaned Bar Screens

255. Drawings, specifications, operation data and advantages of the Rex front cleaned bar screens are covered in Bulletin No. 315-21 available from Chain Belt Co., Milwaukee 1, Wis. Check the reply card.

Pneumatic Sewage Ejector Pumping Systems for Low Flows

317. Dimension and capacity tables for pneumatic float or electrode controlled ejectors, cast iron or welded steel, covering flow ranges of 20 to 600 gpm, including all information necessary in design are given in Bulletin No. KSM-2 3/58. Check the reply card or write Komline-Sanderson Engineering Corp., 101 Holland Avenue, Peapack, N. J.

Descriptive and Performance Data on Sump and Sewage Pumps

351. Performance tables, selection charts, characteristic curves and architect's and engineer's specifications of Pacific sump and sewage pumps are included in complete catalog from Pacific Pumping Co., 9201 San Leandro St., Oakland 3, Calif., or by checking the reply card.

Electric Submersible Contractor Pumps

376. Capacity curves, specifications, accessories and list prices of Flygt electric submersible contractor pumps are covered in literature from Stanco Mfg. & Sales Inc., Construction Equipment, 1666 Ninth St., Santa Monica, Calif. Check the reply card.

Torque-Flow Sewage Pump For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemco torque-flow sewage pump and covers typical installation set-ups. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

4-D Wrought Iron for Building Drainage Systems

551. A comprehensive 64-page catalog on piping for soil, waste, vent and downspout applications is available from A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa. Check the reply card for corrosive conditions, typical installation, performance tables and piping economy.

HAMILTON KENT

TYLOX

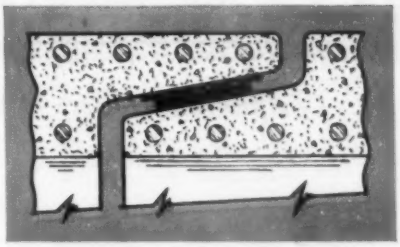
Rubber

PIPE GASKETS

*PREVENT JOINT LEAKS, WHIP CORROSION AND SPEED PIPE WORK ON SEWER PROJECT AT OIL CITY, PA.**

Oil Creek, a watercourse in Oil City, Pa., will be cleaner, purer, and an even greater enhancement to the beauty of the city, as a result of current work being done under Oil City's continuing sewer expansion program. Consisting of several miles of new laterals, new concrete pipe interceptors up to 36″ in diameter, and a new sewage treatment plant, the facilities now being added make it possible to treat all sewage waste disposal before effluent is discharged into the river.

Engineers and officials specified Hamilton Kent TYLOX Rubber Gaskets for coupling the pipe lines, knowing they could count on TYLOX for three important advantages: leak-proof joints to keep infiltration loads negligible at the new plant; acid-resistance to prevent deterioration of the joints and necessity of future repairs; and easier, faster pipe coupling, to help keep construction costs down.



TYLOX Gaskets form a permanently tight **compression** seal. Water can't leak in or out . . . roots and sediment can't penetrate . . . acids can't destroy. Pipe can be coupled in wet trenches . . . backfill may be applied immediately.

5099

WRITE FOR ENGINEERING DETAILS ON TYLOX—
Specify TYLOX FOR YOUR PIPE PROJECTS

* **PROJECT:** Sanitary sewer expansion, Oil City, Pa.

ENGINEERS: Morris Knowles, Inc., Consultants, Pittsburgh, Pa., R. B. Fleming, Resident Engineer.

CONTRACTOR: Ben Construction Co., Pittsburgh, Pa.

PIPE: Reinforced concrete, manufactured by Concrete Pipe Co. of Ohio, Cleveland, Ohio.

HAMILTON KENT
MANUFACTURING COMPANY
KENT, OHIO
427 West Grant Street Orchard 3-9555

CANADIAN PLANT: 10 Brussels St., New Toronto, Ont. Phone CLifford 1-2494

To order these helpful booklets check the reply card opposite page 36.

Weinman Horizontal Non-Clog Centrifugal Pumps

579. Non-clog pumps for sewage and sludge in municipal plants are covered in literature from the Weinman Pump Mfg. Co., 290 Spruce St., Columbus 8, O. Specifications and dimensions are included.

Roots-Connersville Rotary Gas Meters

664. Bulletin M-258 covers complete data on R-C rotary positive displacement meters. Check the reply card or write Roots-Connersville Blower Div. of Dresser Industries, Inc., 559 Poplar Ave., Connersville, Ind., for your copy.

Catalog on Steel Grating

665. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527R available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized SeweRodeR. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif.

STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.

Tractor Loader Can Be Converted Into Eight Different Machines

38. Multiple-purpose tractor loader can be converted to a street sweeper, backhoe, fork lift, angle dozer, crane and rotary broom in a short time. Check the reply card or write Massey-Ferguson Industrial Div., 1009 South West St., Wichita 13N, Kans., for well illustrated catalog.

Automatic Sample Driver For Sub-Surface Exploration

49. This compact portable drilling unit features augering, driving and core drilling for sub-surface exploration. Check the reply card or write Penndrill Mfg. Div., Pennsylvania Drilling Co., 1201-1205 Chartiers Ave., Pittsburgh 20, Pa., for full information.

Damaged Barricades Can Be Repaired With PM Barricade Kits

163. PM barricade kits provide a flexible replacement system for damaged barricades. Check the reply card or write Pacific Mercury, 14052 Burbank Blvd., Van Nuys, Calif., for details on PM transistor neon or incandescent flasher warning lights.

How to Prepare and Maintain Roadways With Calcium Chloride

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided. Check the handy reply card.

Sand and Cinder Spreaders For Streets and Highways

175. PTO with mechanical or hydraulic operation and auxiliary engine with mechanical or hydraulic operation are the choice of drives on these sand and cinder spreaders. Check the reply card or write Baughman Mfg. Co., 152 Shipman Road, Jerseyville, Ill., for complete catalog.

Catalog on Tractor-Driven Tailgate Spreader

182. Highway Equipment spreader spreads in the echelon pattern for ice control and the blanket pattern for seal coating. For literature write Highway Equipment Co., Dept. H41 616D Ave. N. W., Cedar Rapids, Iowa.

Illustrated Specifications on Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 505 York Road, Jenkintown, Pa., or use the handy reply card.

Eaton 2-Speed Axles For Your Trucks

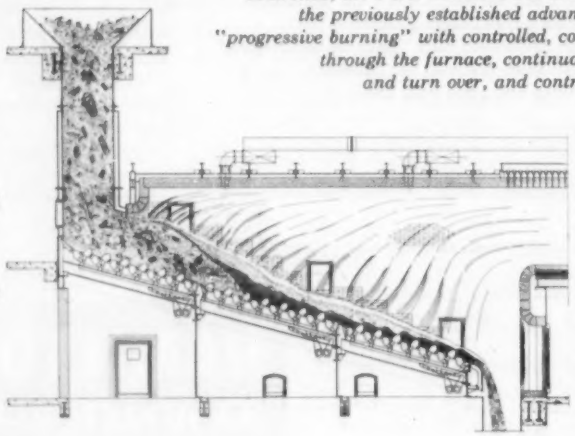
264. Truck axles that provide easy shift, supply positive lubrication and have a self-contained air brake are available from Eaton Mfg. Co. For complete information on these rugged axles check the reply card or write Eaton Mfg. Co., Cleveland, Ohio.

F&E Constant-Flo Incinerator Stoker

Companion Stoker—F&E Multi-Cell Incinerator Stoker

In addition to the F&E Multi-Cell Incinerator Stoker, the Flynn and Emrich Company now offers for those municipalities desiring the continuous flow type of operation, the F&E Constant-Flo Incinerator Stoker, using the latest application of our tried and proven F&E stoker principles. Write today for brochure or plans.

Through automatic operation, electronically controlled, the F&E Constant-Flo Incinerator Stoker combines the previously established advantages of F&E "progressive burning" with controlled, constant flow of material through the furnace, continuous agitation, break up and turn over, and controlled residue disposal.



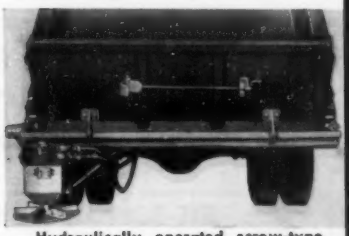
RESULTS—

1. *Reduction of plant operating personnel to absolute minimum,*
2. *Higher rates of destruction with less air pollution,*
3. *Controlled furnace temperatures with much lower furnace maintenance than previously attainable, and*
4. *Refuse reduced more thoroughly at lower cost.*

F&E

FLYNN & EMRICH CO. 301 North Holliday Street, Baltimore 2, Md.

The Performance Features You Want in a Tailgate Spreader!



Hydraulically operated screw-type auger is mounted above truck floor level to prevent bridging of material. No feedgate required because cab-controlled auger regulates flow of material.

The Model TG can be hinged back out of position to permit regular use of dump body, without dismounting the spreader. Oversized materials clogging the auger are easily removed without tools in a few minutes. Simply disconnect the quick-change, no-drip couplings and reverse their positions. This reverses the auger and kicks the obstruction out!

Spread 5 to 40′ at a Flick of the Finger with New HI-WAY Model TG Spreader!

Continuously variable dual-hydraulic cab-controls permit driver to instantly regulate width and depth of spread!

Now, with the new design of the HI-WAY Model TG you can choose any spreading width from 5 to 40′ merely by touching a fast-acting hydraulic control in the cab. A similar control regulates the flow of all material from sand, salt, chips, cinders and calcium chloride to heavy bank sand containing an occasional 2″ stone. This exact control saves time and materials on any job. Waste is further reduced because there is no free-flowing when the auger is stopped. A stabilizer bar keeps the spinner level at all times, regardless of dump body angle. Spreader fits any standard dump body 6′6″ to 8′ wide. The hydraulic drives are powered by low speed, high torque motors.

Pump is driven directly off PTO or supply can be taken from the hoist pump. There are no chains, sprockets, gears or mechanical drives to foul up. Means more usable power, fewer parts, minimum maintenance!

Write for the latest literature and complete specfications.

HIGHWAY EQUIPMENT COMPANY

618B D. Ave. N. W. Cedar Rapids, Iowa

To order these helpful booklets check the reply card opposite page 36.

Useful Attachments for "Payloader" Tractor Shovels

99. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Handbook for Engineers on Design and Construction of Culverts

121. Metal pipe specifications, highway, municipal and airport drainage facts, selecting a drainage structure, designing waterway area, designing for structural strength and headwalls and inlets are sections covered in this handbook. Check the reply card or write Republic Steel Corp., Culvert Div., 2318 — 13th St., N.E., Canton 5, Ohio.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Case Utility 310B Backhoe-Loader

282. The Case wheel-mounted backhoe-loader is described and illustrated in 8-page, 3-color Bulletin CUS-110, released from J. I. Case Co., Racine, Wis. Check the reply card for mechanical details of the backhoe, loader and heavy-duty tractor.

All Purpose Maintainer for Road Departments

313. Attachments for Huber-Warco maintainer include a lift-loader, backfilling blade, bulldozer, broom, patch roller, snow plow and mower. For Bulletin No. HWM512 write Huber-Warco Co., Marion, Ohio, or check the reply card.

The Principles of Compaction by Vibration

288. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1950 Sante Fe Ave., Los Angeles, Calif.

How To Build Stabilized Heavy Traffic Pavements

300. A 16-page booklet published by Seaman-Andwall Corp., 13050 West Blue Mound Rd., Elm Grove, Wisc. shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worthwhile booklet for every highway engineer.

Manual on Steel and Wire for Road Building

337. Design data on wire fabric for concrete pavements, joint data, guardrail design standards, steel and wire for concrete pipe and reinforced bituminous concrete design are some of the sections covered. Check the reply card or write American Steel & Wire Div. of United States Steel Corp., Cleveland 13, Ohio, for this valuable manual.

Concrete Admixtures and Joint Sealers

346. Retarding and accelerating densifiers for concrete and mortar, coatings for exposed aggregate concrete, non meltable mastic waterstops and quicksetting products are covered in 8-page bulletin available from Sika Chemical Corp., 29-49 Gregory Ave., Passaic, N. J.

Hand Operated Soil Sampling Kit

366. Bulletin 26-R describes the Acker soil sampling kit that contains 12 different soil sampling tools packed in a handy steel case. Check the reply card or write to Acker Drill Co., Inc., P.O. Box 830, Scranton 2, Pa., for data on tools that are designed to take soil samples from practically any material.

Data on Eimco, the Modern Crawler Equipment

358. Front end loaders, dozers, and fork lifts are some of the attachments available for the Eimco tractor. Check the reply card or write The Eimco Corp., Salt Lake City, Utah, for facts and qualified engineering assistance.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Bitumastic For Lasting Protection Against Corrosion

570. Bitumastic protective coatings prevent corrosion of metal and deterioration of concrete and masonry and are fully covered in catalog from Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa.

Vacuum Cleaner and Leaf Collector For Cleaner Streets

595. A unit is now available that can be mounted on a right-hand drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y.,

A new concept for **safe**

HIGHWAY MOWING!

MOTT Hammer-Knife mowers! One mower for all hi-way mowing jobs . . . rough or smooth—grass or weeds—wet or dry! The in-line cutting action is in the direction of travel. It cuts evenly —without scalping—through ditches, over banks and along roadways. The unique flail-type cutting action deflects the shredded clippings to the ground—not even a blade of grass is tossed sideways. There's no danger of flying sticks, stones and other debris. MOTT *is* safe . . . safe to operator and safe to passing traffic.

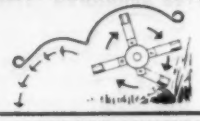
Dual Economy . . .

MOTT is low in operating costs and maintenance cost. Proven in actual use to stand up under the most rugged hi-way mowing conditions. The free-swinging knives can be sharpened repeatedly and eventually replaced at dime store prices. 32 models from 18 in. to 19 ft. New type 13 ft. convertible gang hitch shown. Also available in standard rear or underslung mountings—4, 5 or 6 ft. widths.

We invite you to try the MOTT Hammer-Knife mower under your own mowing conditions—then compare! Seeing is believing. See your local dealer—or write for complete literature.

EVEN CUT ON ALL TERRAIN

SAFE--DOWNWARD CUTTING



LOW MAINTENANCE

balanced shaft and replaceable blades

mott® HAMMER KNIFE®

MOTT CORPORATION

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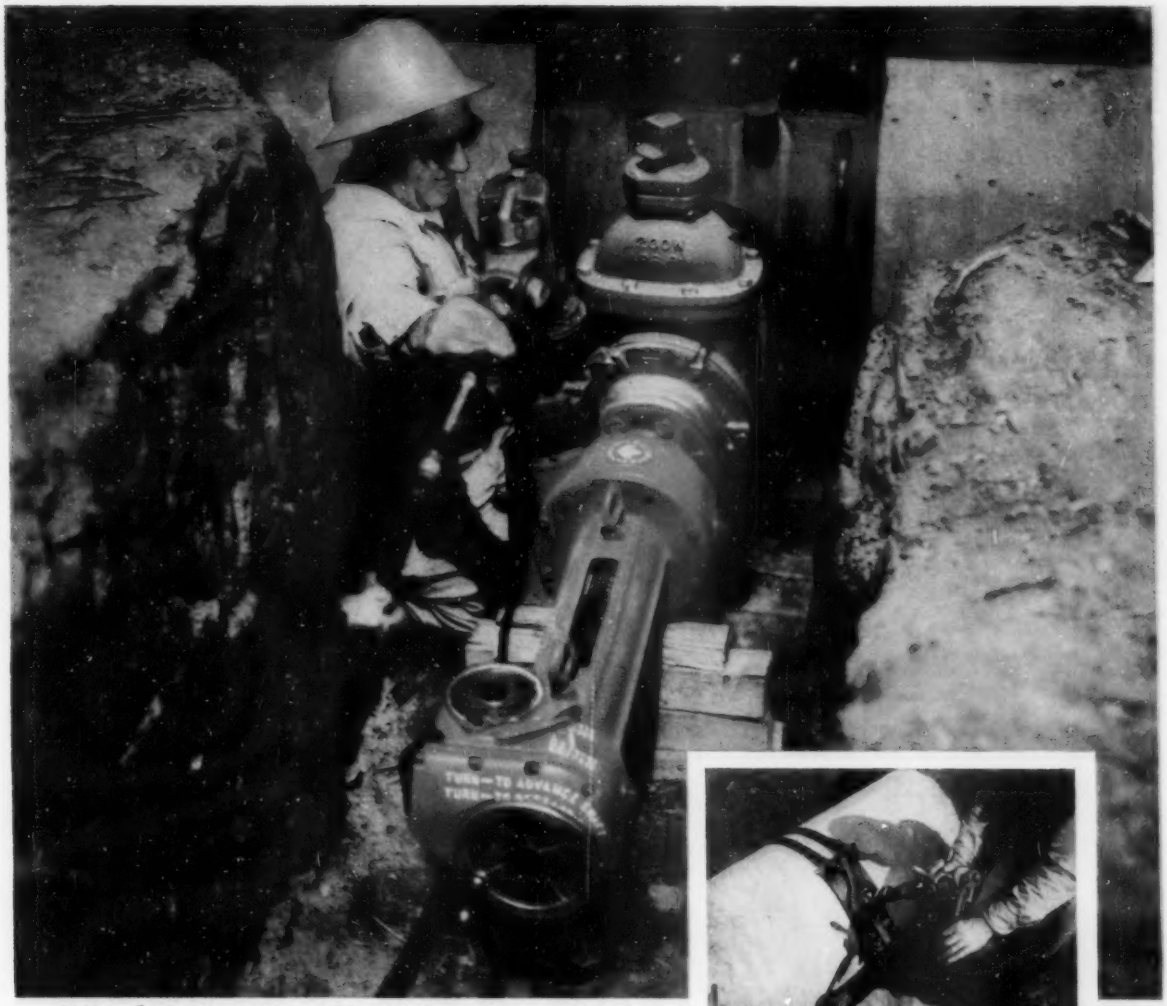
Brookfield, Illinois



Making a 6" outlet under pressure in a 20" Lock Joint Prestressed Concrete Cylinder Pipe.

Tapping a 1" house connection under pressure in Lock Joint Concrete Pressure Pipe.

TAPPING LOCK JOINT CONCRETE PRESSURE PIPE

Simple...Efficient...Time-tested

Thousands of field installations have proved the ease and efficiency with which LOCK JOINT CONCRETE PRESSURE PIPE can be tapped under pressure. Service connections as well as larger outlets up to 36" in diameter can be made without interruption of service or damage to the line.

In addition to safe, easy tapping of all diameters, LOCK JOINT CONCRETE PRESSURE PIPE also combines long life, dependability, permanent high carrying capacity, ease of installation, and negligible maintenance. These features make it the logical choice for distribution piping as well as water transmission lines.

LOCK JOINT PIPE CO.

East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo. • Perryman, Md.

Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

To order these helpful booklets check the reply card opposite page 36.

MORE THAN 2000 PRESTRESSED CONCRETE TANKS IN SERVICE

Look at these features:

- No maintenance required
- 75% construction cost spent locally
- Lowest overall cost to community
- Owners never return to other types
- Longest service life of any tank

Send for Bulletin T-22

PRELOAD

THE PRELOAD COMPANY, INC.
211 East 37th St., New York 16, N. Y.
351 Jefferson, Dallas, Texas
711 Perimeter Road, Kansas City, Mo.

PRELOAD CONCRETE STRUCTURES INC.
837 Old Country Road
Westbury, Long Island, New York

HERRICK IRON WORKS
28400 Clawiter Road
Hayward, California

THE CANADA GUNITE COMPANY, LTD.
7325 Decarie Blvd.
Montreal 16, Canada

What's Your Digging Problem? Repair Work? Trenches? Footings?

518. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam; work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 180° arc and dig to a depth of 12 feet. For full details check the reply card. Sherman Products, Inc., Royal Oak, Mich.

Highway Mowing with the Mott Hammer-Knife

625. One mower for all highway mowing jobs whether rough or smooth, grass or weeds, wet or dry. Check the reply card or write Mott Corp., 4009 Eberly Ave., Brookfield, Ill.

Chevrolet Trucks for 1959

642. Chevrolet trucks for 1959 feature more models, thriftier engines, stronger cabs and frames, safer brakes and tougher axles and transmissions. Write to the Chevrolet Div., General Motors, Detroit 2, Mich., or check the reply card for complete data on these new trucks.

All-Steel Safety Barricade

709. Highway departments and contractors can use this Guard-Gate in construction and maintenance. Write West Side Iron Works, Inc., 327 Front Ave., N.W., Grand Rapids 4, Mich., or check the reply card for literature on this collapsible barricade.

●

CONSTRUCTION EQUIPMENT AND MATERIALS

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

Pipe Cutter for Cutting Large Size Pipe

254. An all-purpose pipe cutter that can cut pipe in or out of the ditch is described in a bulletin available from Ellis & Ford Mfg. Co., P. O. Box 308, Birmingham, Mich. Check the reply card for sizes and parts list.

Austin-Western Construction Equipment Catalog

260. Power graders, street sweepers, road rollers, crushing and screening plants and hydraulic cranes are covered in catalog from Austin-Western, Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Aurora, Ill.

Manual on the Use and Application of Compactors

261. A Manual covering the various types of compaction equipment in use today and including rollers and vibratory compactors is available from The Galion Iron Works & Mfg. Co., Galion, O. Check the reply card for details on the problems encountered in the efficient compaction of various materials, and the correct use of compaction equipment available.

Why and How To Use Pneumatic Tired Rollers

290. The why and how of pneumatic tired rollers on base and surface courses, sealing completed fills, surface treatments, floated surfaces, hot and cold asphalts and stabilized soils are covered in Bulletin 10 from Tampo Mfg. Co., San Antonio, Tex. For information on operating conditions and compaction charts check the reply card.

Barber-Greene Continuous Asphalt Plants

320. This catalog covers the Model 848-A asphalt plant and presents each typical plant setup and separately shows the details of each component. Check the reply card or write Barber-Greene, Aurora, Ill., for your copy.

Power Tamper for Granular Soil and Bituminous Surfacing Work

342. The Kelley Power Tamper is a self-propelled unit that is equivalent to a 10-ton roller for backfilling, road widening jobs and compacting around culverts and pipeline trenches. For complete specifications write Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Hinman Ave., Buffalo 23, N. Y., or check the reply card.

Complete Line of Shovels, Draglines, Cranes and Clamshells

361. Bucyrus-Erie crane-excavators in sizes from ¾ to 4 cu. yd. capacities are covered in literature from Bucyrus-Erie Co., South Milwaukee, Wis.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication.

4-Wheel Drive Tractor Loaders

434. A 16-page Catalog, No. 1033-5-57, describing the "Tracto-Loader Line" of front end wheel loaders is available from Tractomotive Corp., Deerfield, Ill. Covered are the five models that are in production.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 155 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

Drott TD-15 "4-in-1" Skid-Shovel

504. Features of the Drott skid-shovel are graphically depicted in 16-page, two-color catalog available from International Harvester Co., Consumer Relations Dept., 180 N. Michigan Ave., Chicago 1, Ill. Check the reply card for complete descriptions.

Allis-Chalmers Motor Graders and Diesel Crawler Tractors

556. Complete data on the Model Forty-Five motor grader and the HD-16 and HD-16 DC and D diesel powered crawler tractors are covered in bulletins from Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

How Good Are Your Truck Drivers? The Tachograph Will Tell You

682. Accurate records of truck engine operation are made available by the Tachograph. Find out how savings and safety can be promoted by getting Bulletin SU-3 from Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo. Details of construction and descriptions of operation are included.

(More listings on page 54)

DOW | **HERBICIDES**

Spray down high costs

of roadside weed control with DOW chemicals

During horse-and-buggy days it was difficult to define the road from the roadside . . . manual weed control made sense then. But today ragged brush infested roadsides stick out like a sore thumb against the flowing beauty of modern roadways. Vast expanses of highways and increased labor costs create need for up-to-date methods. That's why state after state has turned to Dow chemicals for roadside vegetation control; the programed use of the right herbicide, properly applied and scheduled.

In many cases the right herbicide is Garlon*, a remarkably quick, economical product recently developed by Dow for killing (or eliminating) broad-leaved weeds and grasses. Easy to prepare and use, Garlon also serves as a perfect supplement to right-of-way mowing, controlling growth around posts and other obstacles. Where brush is your big problem Esteron* 245 O.S. or Esteron Ten-Ten* controls growth and reduces expensive hand-work around fences and signs. Whatever your vegetation control problem, there's a proven Dow formulation to answer it. Surer growth control and progressively reduced roadside costs are yours with planned *chemical* control. For additional facts on the use of chemicals in roadside maintenance write today to: THE DOW CHEMICAL COMPANY, Midland, Michigan, Agricultural Chemicals Sales Department 206EC7.

*TRADEMARK OF THE DOW CHEMICAL COMPANY

The Dow Chemical Company
Agricultural Chemicals Sales Dept. 206EC7
Midland, Michigan

☐ Please send me additional information about roadside vegetation control chemicals.

NAME_____

HIGHWAY DEPT._____

ADDRESS_____

CITY_____ STATE_____

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

TRACTOMOTIVE charts the

These charts are your guide for choosing a bucket and a loader that is just right for your job. You will operate at highest efficiency with the correct size bucket and the right size loader — get the highest possible production. No costly maintenance from overloading! And your loader will last longer, too. There's a whole family of buckets to choose from for each machine in the 5,300, 7,000 and 9,000-lb carry class.

How to use the charts

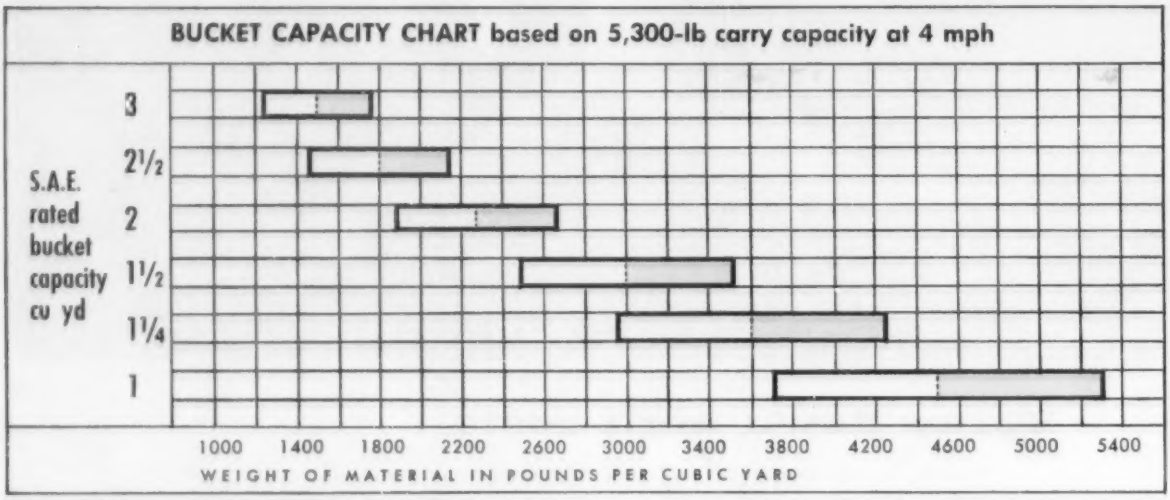
The bar opposite each bucket size shows the weight of materials per cu yd that you can handle with this size bucket. The area in color on the right side of the dotted line in the bar indicates the weight of materials that can be handled where loading is normal and operating conditions are good. The left side of the bar indicates the weight of materials that can be handled where conditions are adverse — such as steep grades, rough ground, or where you get excessive heaping.

Example: Suppose you are loading sand weighing 2,600 lb per cu yd. If your operating conditions are good and you get normal loads, you would choose the 3-yd bucket for the TL-20, the 2½-yd for the TL-16, or the 2-yd for the TL-14.

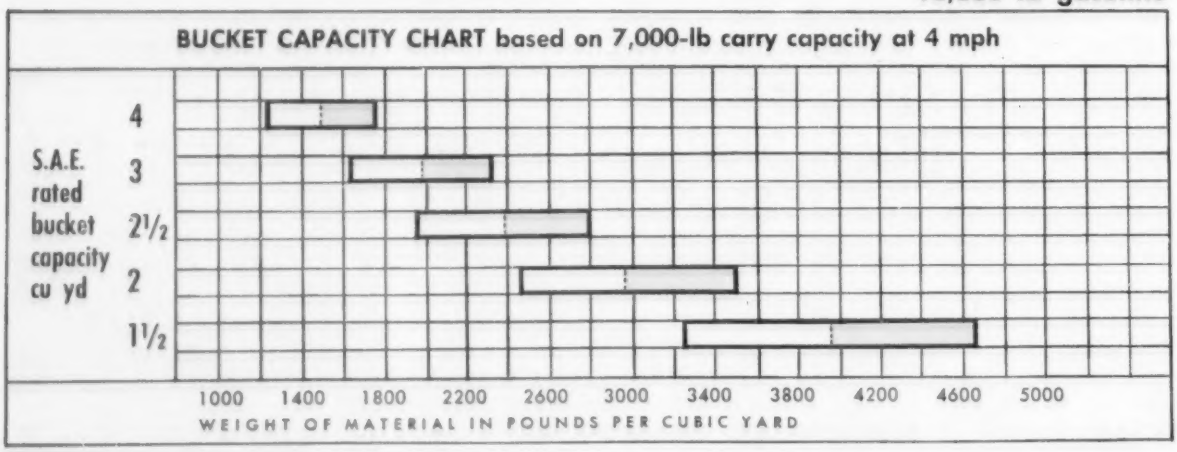
If your operating conditions are adverse or you get excessive heaping, you would choose the 2½-yd bucket for the TL-20, the 2-yd for the TL-16, or the 1½-yd for the TL-14.

Your Allis-Chalmers dealer will be glad to go over these charts with you . . . discuss your job requirements and help you select the most efficient size bucket and loader for your work.

TL-14 TRACTOLOADER 81.5 hp diesel • 86 hp gasoline • Weight: 14,480 lb

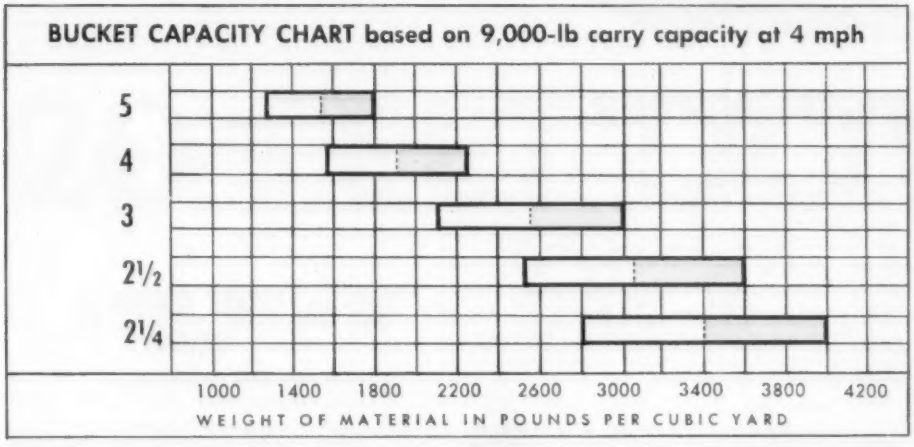

BUCKET CAPACITY CHART based on 5,300-lb carry capacity at 4 mph
S.A.E. rated bucket capacity cu yd
3
2½
2
1½
1¼
1
1000 1400 1800 2200 2600 3000 3400 3800 4200 4600 5000 5400
WEIGHT OF MATERIAL IN POUNDS PER CUBIC YARD

TL-16 TRACTOLOADER 104 hp diesel • 109 hp gasoline • Weight: 17,600 lb diesel 16,380 lb gasoline


BUCKET CAPACITY CHART based on 7,000-lb carry capacity at 4 mph
S.A.E. rated bucket capacity cu yd
4
3
2½
2
1½
1000 1400 1800 2200 2600 3000 3400 3800 4200 4600 5000
WEIGHT OF MATERIAL IN POUNDS PER CUBIC YARD

way to proper bucket selection

TL-20 TRACTOLOADER 130 hp diesel • Weight: 23,150 lb



To find out what a **TRACTOLOADER®** can do for you . . . ask your Allis-Chalmers dealer to show you **"And a Great Deal More."**

SOLD AND SERVICED BY YOUR ALLIS-CHALMERS DEALER

TRACTOLOADERS
TRACTOSHOVELS
TRACTORIPPERS
TRACTOHOES
TRACTOSIDEBOOMS

TRACTOMOTIVE

TRACTOMOTIVE CORPORATION • DEERFIELD, ILLINOIS

TRACTO — *a sure sign of modern design*

To order these helpful booklets check the reply card opposite page 36.

Basic Fundamentals of High-Speed Earthmoving Techniques

617. This bulletin illustrates and explains the major factors in earthmoving equipment selection. Check the reply card or write the Advertising Division of Caterpillar Tractor Co., Peoria, Ill., for charts and performance characteristics.

Use The Reply Card

Are You Having Compaction Problems?

676. Small, self-propelled, one-man operated heavy-duty vibratory tampers enable you to compact any material to specifications. Literature available from Vibro-Plus Products, Inc., Stanhope, N. J., or by checking the reply card.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Expansion Joints Used In Concrete Construction

680. Asphalt, fibre, corkfill and sponge rubber expansion joints are covered in catalog on Sealtight joints and other top-quality Sealtight products available from W. R. Meadows, Inc., 25 Kimball St., Elgin, Ill. Check the reply card for data on how these expansion joints are used in pavements, runways, bridges, ramps and other concrete structures.

TREES AND WATER

Strange as it may seem, there are some disadvantages to civilization. Two of them are water pollution and ground water shortage.

The more people in a community, obviously the more serious the water pollution prospects become, due to both domestic and industrial waste materials. Also as populations grow, forest areas tend to decrease. Growing cities, new and bigger industries, more and larger farms mean less forested area and less trees, faster rainfall runoff and less ground water storage. Trees and underbrush are Nature's way of helping rainfall soak into the ground instead of running off into streams, rivers, and the sea.

Apparently Mother Nature and the Human Race need to make some adjustments in order to satisfy each other. Ground water shortage is one of the big problems facing the American water works industry, and emphasizes the fact that the job of water works superintendent is vitally important to the American way of life. Give your water works superintendent a hand—whenever you can.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

A SUBSIDIARY OF WALWORTH

STREET LIGHTING AND TRAFFIC CONTROL

New Reflectorized Sign Faces Refurbish Old Traffic Signs

292. Get complete details on new "Ez-On" traffic sign faces ready for immediate shipment. Reflectorized faces cost about one half as much as new signs and are easily attached to existing traffic signs. Grace Sign & Mfg. Co., St. Louis 18, Mo.

3M Letters for Large Reflectorized Signs

374. "3M Signal" letters are made with "Scotchlite" reflective sheeting encapsulated in acrylic plastic and are used on large reflectorized signs. Check the reply card or write Minnesota Mining and Mfg. Co., St. Paul 6, Minn., for full details.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans., for your copy.

Handbook on Aluminum Traffic Control Devices

546. Subjects covered in this handbook are sheet signs, extruded signs, sign posts, street signs, and complete specifications for many aluminum uses. A list of Alcoa sales offices is included. Check the handy reply card or write to Aluminum Company of America, Alcoa Building, Pittsburgh 19, Pennsylvania, for mounting, determining size of sign posts and other information today.

Aluminum Beam Guard Rail Ends Maintenance

619. Specifications, drawings and installation of Alcoa Aluminum Company of America, Dept. 1912-E, Alcoa Bldg., Pittsburgh 19, Pa. Check the reply card.

Literature on Reflective Glass Beads

690. Glass beads for traffic signs and street name signs are described in literature available from Flex-O-Lite Mfg. Corp., 8305 Flex-O-Lite Drive, P. O. Box 3066 (Affton Br.), St. Louis 23, Mo. Beads can be used on white and yellow signs. Check the reply card.

SNOW AND ICE CONTROL

Bare Pavement Maintenance With Sterling Rock Salt

84. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Scranton, Pa.

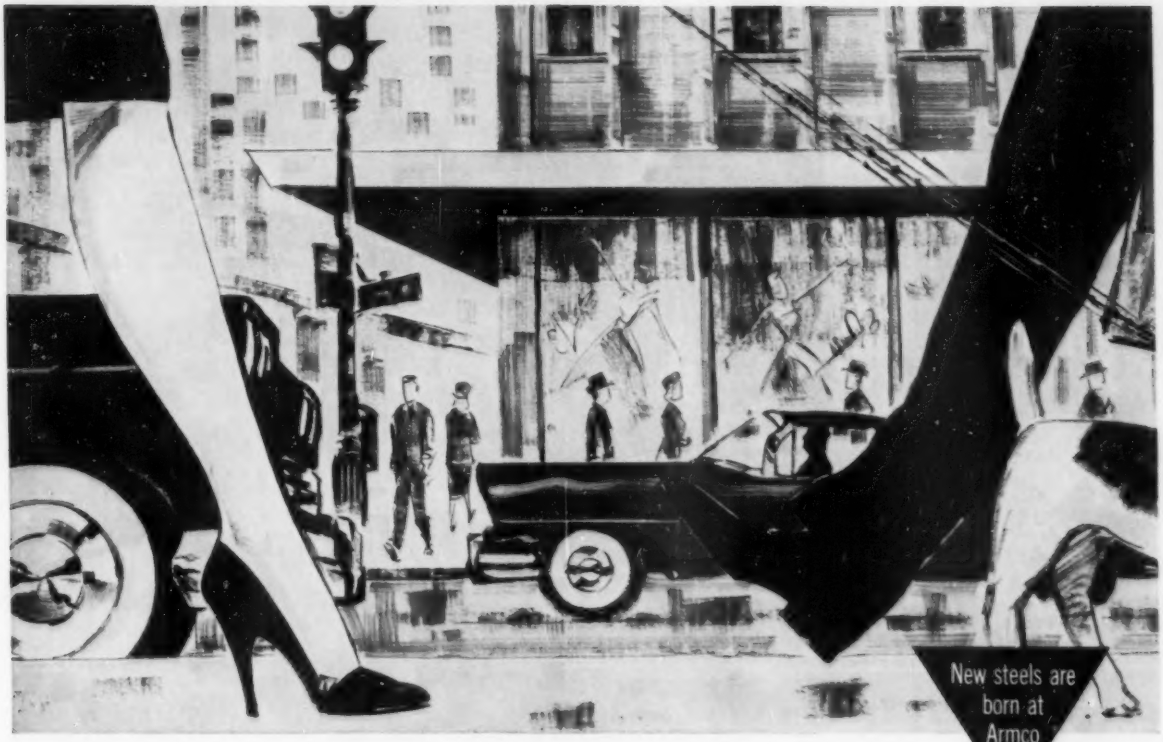
Complete Ice and Snow Fighting Equipment

523. Snow plows in 55 models and 9 types, material spreaders with width of spread of 8 to 20 ft. and hopper capacity of 2 cu. ft., and truck grader ice blades are covered in literature from Wausau Iron Works, Wausau, Wisc. Check the reply card.

Rock Salt For Ice and Snow Removal

534. Application rates and procedures of using Morton rock salt for ice and snow control are covered in catalog from Morton Salt Co., 110 No. Wacker Drive, Chicago 6, Ill. Check the reply card for Catalog F-35.

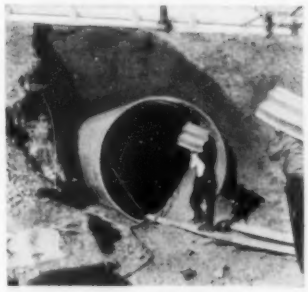
Traffic as usual, but . . .



20 FEET DOWN

a new sewer is going in

When you tunnel with Armco Liner Plates you keep work underground . . . no traffic interruptions. You save the surface, too. Armco Liner Plates are the strongest made – pound-for-pound. Write for Armco Liner Plate Catalog. Armco Drainage & Metal Products, Inc., 7149 Curtis Street, Middletown, Ohio.



Armco Liner Plate sections are light enough for easy handling.

ARMCO DRAINAGE & METAL PRODUCTS

Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

To order these helpful booklets check the reply card opposite page 36.

The makers of ***THE BIG E*** *announce. . .*

ANOTHER ADVANCED DESIGN SERIES OF MODERN TRACTORS AND TRACTOR UNITS

the EIMCO 103

The Eimco Corporation, pioneer in MODERN tractor engineering and design, now brings you the **first modern tractor specifically** engineered to fill your size, power and work needs in the **medium size tractor** field . . . **the 103 series!**

Eimco 103 — Tractor only
Eimco 103 — with Dozer attachments
Eimco 123 — Efficient Front End Loader
Eimco 133 — Special Steel Mill FEL
Eimco 143 — Log Loader

LOOK AT THESE FEATURES . . .

100 horsepower . . . General Motors or Cummins Diesel Engines of latest modern design.

Quadra-Torque . . . the modern power team with four forward and four reverse gears. Permits shifts from any gear, forward or reverse, to any other at any tractor or engine speed without slowing or stopping the tractor.

Unidrive and Dual Final Drives . . . with independent track operations for smooth, safe spin turns without track-drag. Simple, reliable, powerful.

Up to 33,000 lbs. drawbar pull . . . with adequate traction, through the Quadra-Torque Unidrive-Torque converter power team.

Unitized "Stress Flow" Construction . . . newest Eimco exclusive. Large, strong steel castings are molded to shape required, with thickness varied as required to withstand maximum stresse. Main frame, final drive and center housings one strong casting! No bolts or welds. Components readily accessible.

Up-front operator position . . . for maximum control and visibility.

Simple controls . . . with power shifting. No clutch. No stalling. Flip of a lever controls speeds, forward, reverse, insures more work output.

Get all the facts before you buy. WRITE for full specifications. Contact Dept. AN-3 — The Eimco Corporation, P. O. Box 300, Salt Lake City, Utah.

"Advanced Engineering and Quality Craftsmanship Since 1884"

THE EIMCO CORPORATION
SALT LAKE CITY, UTAH

B-434

EXPORT OFFICE, 51-52 SOUTH STREET, NEW YORK, N. Y.
BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

REFUSE COLLECTION AND DISPOSAL

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy reply card.

Information on the Hydepak Refuse Packer

437. The Hydepak refuse packer is designed so that a lighter more economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd. capacities. For complete specifications write Hydepak Division, Hobbs Trailers, 609 No. Main, Fort Worth, Tex., or check the reply card.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

WEED AND DUST CONTROL

Heavy-Duty, Non-Volatile Brush and Vegetation Killer

116. Quick acting, complete kill and no drifting Fence Fire kills all brush and weeds with one gallon making up to 100 gallons of spray. Write The Gledhill Road Machinery Co., Galion, Ohio.

How to Stop Bothersome Dust

433. A bulletin that covers the use of calcium chloride in the control of dust is available from Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich. Tables on the use of calcium chloride pay are included. Check the reply card.

Control Weeds and Brush Along Highways

640. Literature from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, describes how use of weed and brush killers help reduce accidents and also included is a handy, ready-reference control chart that covers weed control problems, quantity of solution to use and economical application. Check the reply card.

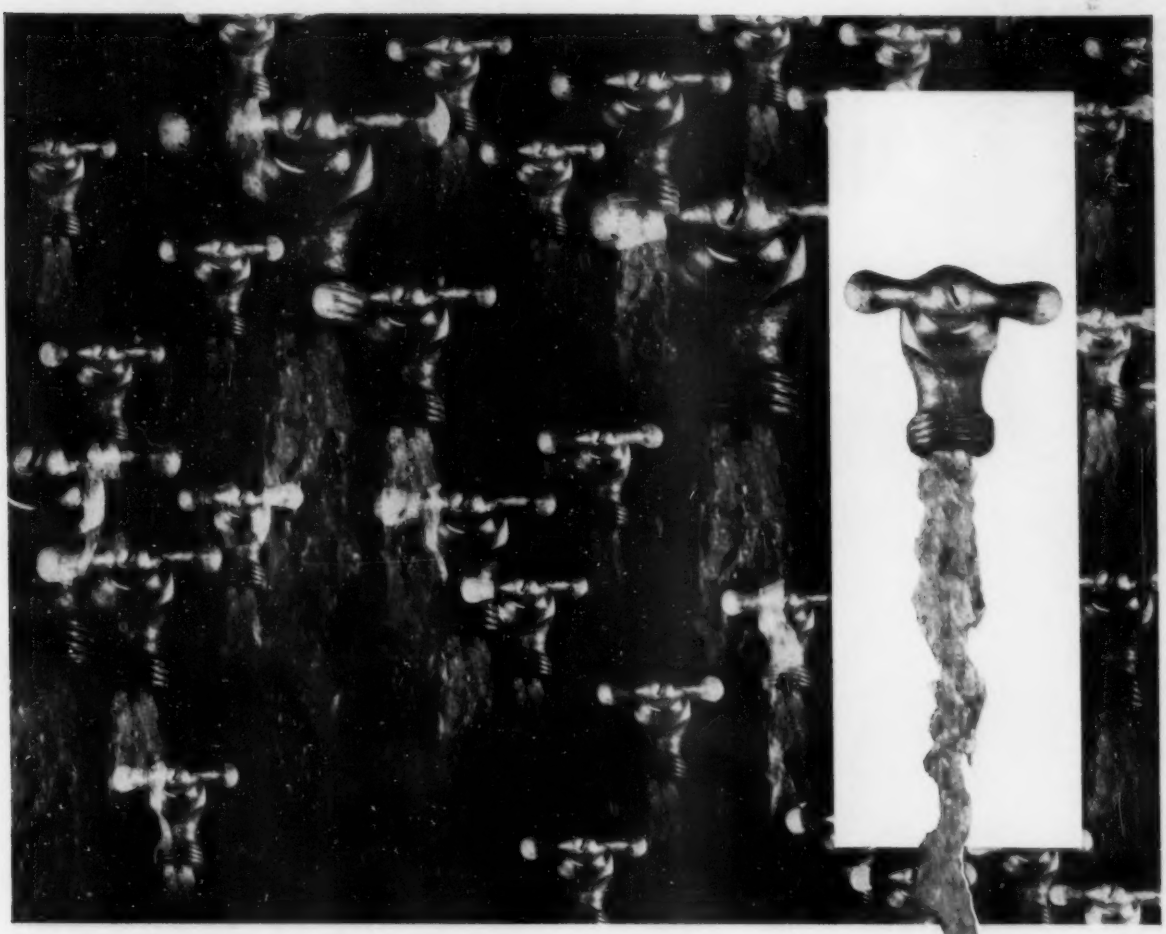
RECREATION

Heavy Duty Swimming Pool Equipment for Municipal Pools

193. Illustrated bulletin showing heavily built diving and deck equipment is available from American Playground Device Co., Anderson, Ind. Check the reply card for specifications on diving boards, data on diving stands, towers, slides, pool ladders and pool cleaning equipment.

Rubberized Playground Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the reply card or write to U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y.



450-1 flow range

TOTALIZED ON ONE REGISTER

SPARLING BROAD GAUGE COMPOUND METERS

No conversion; no duplication; no wasted water... Sparling Broad Gauge Compound Meters provide the broadest range of accurate metering available, with all flows *registered on one totalizer.*

LOW FLOWS, down to 2.5 gpm, are registered with the positive accuracy of a displacement meter... **HIGH FLOWS** utilize the exclusive Sparling propeller meter design for maximum accuracy and minimum head loss. Flows metered up to 2250 gpm are standard... **TOTAL FLOWS** up to a 450 to 1 range are registered on one common 6 digit straight-reading totalizing register within 2% accuracy. Available in sizes 6"x 1½", 8"x 2", 10"x 2", 12"x 2".

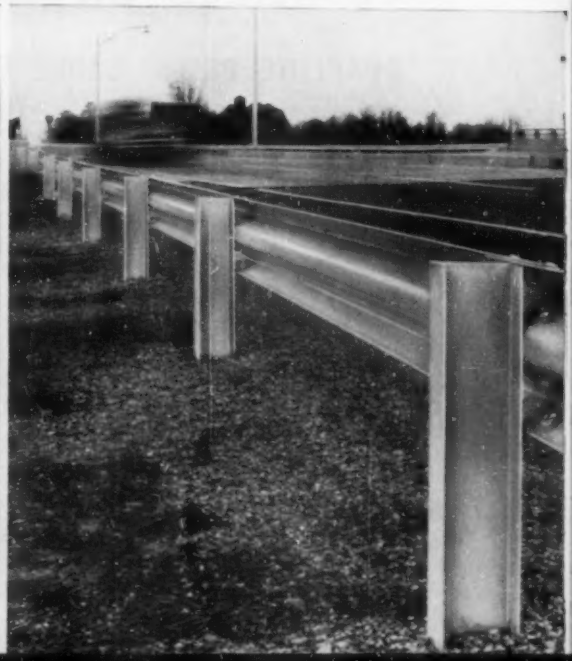
Write for Technical Bulletin No. CF 333-1

SPARLING
WATER CONTROL EQUIPMENT

SPARLING METER COMPANY *225 N. Temple City Blvd., El Monte, California*

Atlanta 3 • Chicago 4 • Cleveland 13 • Dallas 1, Tex. • Denver 6 • Kansas City 6, Mo. • Roselle, N. J. • San Francisco 24 • Seattle 99 • Romford, England

Quickly driven steel posts and easily attached steel beams produce a strong, highly visible and economical guard rail.



Traffic protection at its best

USS AmBridge Highway Beam Guard Rail and Posts

Rugged, flexible, highly visible steel beam guard rail firmly bolted to sturdy steel posts is the strongest, surest traffic safeguard available. And economical too, since the posts are readily driven and the guard rail is easily spliced and installed.

Both of these AmBridge highway products are available quickly. Besides possessing all of the features of the modern Universal Guard Rail Section, USS AmBridge Highway Beam Guard Rail offers these extra advantages:

1. *All* mill scale is removed before the guard rail section is formed, assuring uniform, tenacious paint adherence.

2. Prior to painting, all sections are degreased, given two hot water rinses, and oven dried. Then a coat of rust-inhibiting shop primer is applied.

3. USS AmBridge Beam Guard Rail can be furnished in 25' lengths, cutting splicing requirements in half and appreciably reducing bolt costs.

For more information, get in touch with any of the offices listed below. *USS is a registered trademark*

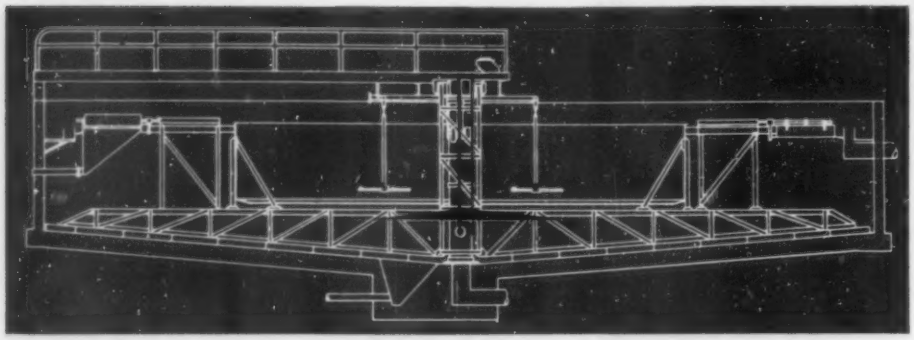
New Movie Available—

"Challenge at Carquinez—Project 56-14," an interesting sound and color 16mm film. Showing time, 25 minutes. For free booking, write to Pittsburgh, Pa.

American Bridge Division of United States Steel

General Offices: 525 William Penn Place, Pittsburgh, Pa.
Contracting Offices in: Ambridge, Atlanta, Baltimore, Birmingham, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Elmira, Gary, Harrisburg, Pa., Houston, Los Angeles, Memphis, Minneapolis, New York, Orange, Texas, Philadelphia, Pittsburgh, Portland, Ore., Roanoke, St. Louis, San Francisco, Trenton, United States Steel Export Company, New York

Another Eimco-Process design innovation . . .



Internal sludge recirculators, Non-Clog Diffusers and a sludge thickening deflector are exclusive features of the Type CA Oxidator.

EIMCO-PROCESS OXIDATOR®—WITH CONTROLLED INTERNAL SLUDGE RECIRCULATION—INCREASES SOLIDS AND BOD REMOVALS

The complete line of Eimco-Process Oxidators, Clarifiers and other sedimentation equipment is described in our new Bulletin SM-1005. We will be happy to send you a copy on request.

Developed and introduced by Eimco-Process, and with a number of exclusive features, the Oxidator combines aeration, flocculation and sedimentation in a single circular tank. When aeration and flocculation of the solids are provided prior to clarification, many finely divided and colloidal solids that could not be removed by conventional sedimentation are flocculated and collected with the sludge. The aeration keeps the influent fresh and, combined with controlled internal sludge recirculation, gives increased floccule size, minimizes scum formation, and gives increased suspended solids and BOD removals.

In this unique design, internal sludge recirculation is accomplished through airlifts with intakes below the special sludge pocket protection deflector. By placing the intakes in this protected heavy sludge zone and controlling each lift with a separate valve, optimum recirculation rates can be obtained.

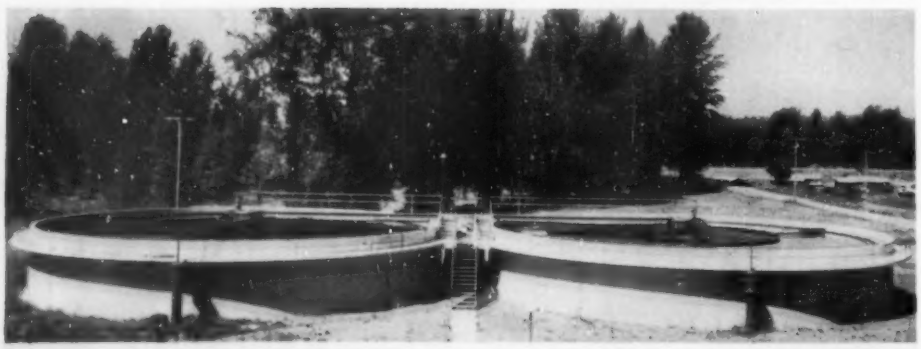
Gentle or intense aeration, adjustable sludge recirculation rates and controlled sludge thickening make the Oxidator the most flexible of all sedimentation equipment. Used alone, it can provide economical intermediate treatment; used with secondary equipment, it can substantially reduce total plant investment.

THE EIMCO CORPORATION
Salt Lake City, Utah

B - 394

PROCESS ENGINEERS, INC. *division*
420 Peninsular Avenue
San Mateo, Calif.

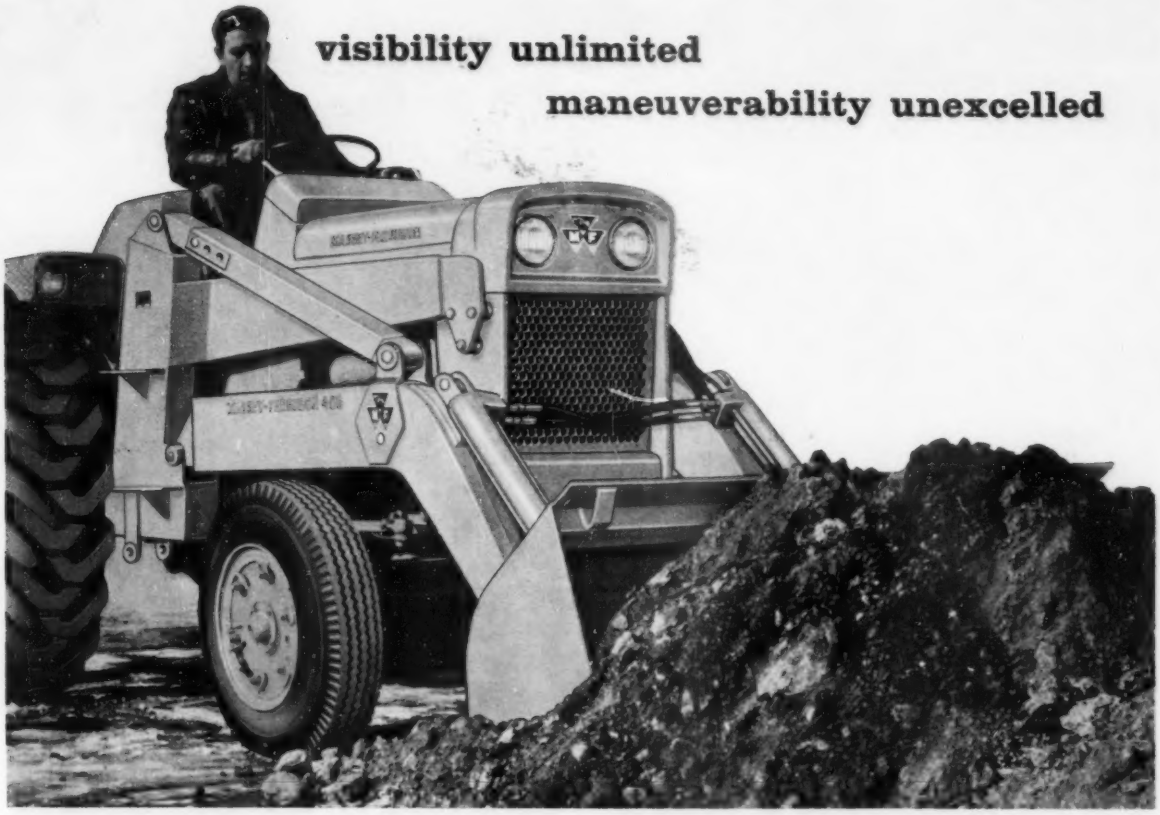
. . another outstanding installation



Two 75 ft. dia. Type CA Oxidators, Puyallup, Washington. Consulting Engineers—Gray and Osborne, Yakima, Wash.

visibility unlimited

maneuverability unexcelled



new MASSEY-FERGUSON 406

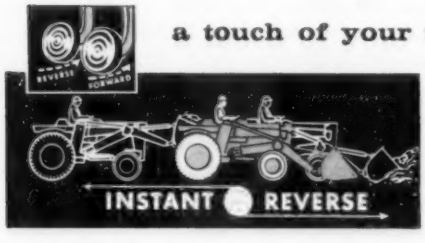
the BIG CHANGE *in tractor shovels*

Have loading power at your finger tips. . . speed and directional control at a touch of your toe. . . and see wherever you go — that's why this all-new, streamlined Massey-Ferguson 406 is the BIG CHANGE in tractor shovels.

Instant Reversing, all-around visibility, full 1 cu. yd. bucket, lets you get more loads, bigger loads, and outperform larger, more expensive machines. And, you can handle the precision, utility jobs more efficiently and economically. Low-thrust point, high reach, multitude of integrated attachments including the famous Davis Backhoe make it the most versatile, profit-producing rig in its class.

IT'S WORTH BUYING!

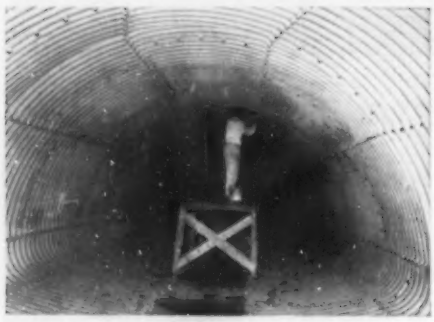
For a real eye-opener, let your Massey-Ferguson Industrial Dealer demonstrate this "years ahead" tractor shovel for you. Write for his name and illustrated literature.



a touch of your toe — away you go — forward or reverse

MASSEY-FERGUSON INDUSTRIAL DIVISION

Block 1000 South West Street • Wichita 13N, Kansas



INTERIOR of completed Republic Sectional Plate Pipe-Arch is shown above. Installation is quick and easy. Structures can be installed with simple tools, unskilled labor. Only a minimum of excavation is required.

HEADWALL of reinforced concrete completed Rome, New York's drainage enclosure. When completed and backfilled, a structure such as this can eliminate maintenance and replacement worries for many years to come.

Flood-Spot Becomes Fun-Spot in Rome, New York

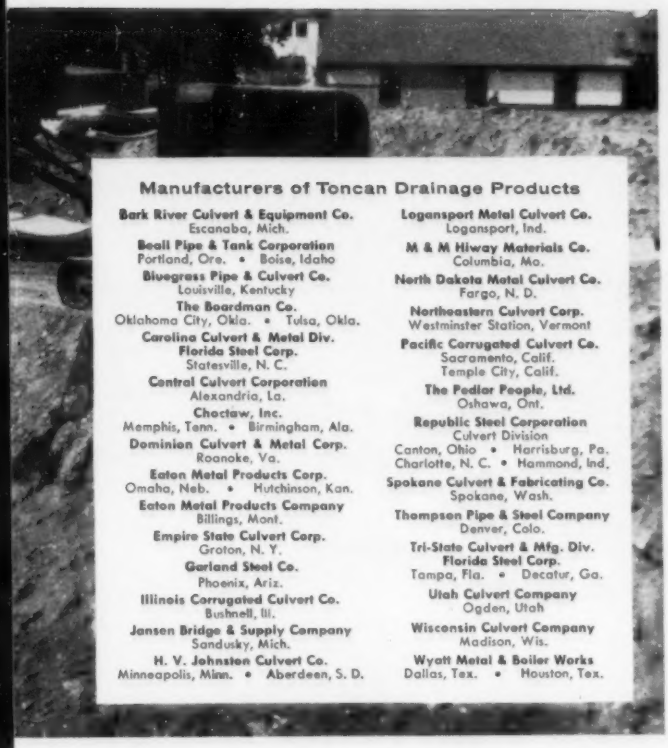
REPUBLIC SECTIONAL PLATE PIPE-ARCH MAKES STREAM VANISH

Once in Rome, New York, there flowed an unsightly, unwanted stream, with an unpleasant habit of overflowing its banks, creating a minor flood problem nearby. Today, the stream has vanished —whisked underground—and the surrounding "floodland" has become a pleasant recreational park. The pictures shown here illustrate how installation of Republic Sectional Plate Pipe-Arch helped to accomplish this transformation.

The stream was re-routed, and enclosed underground in a 391-foot Republic Sectional Plate Pipe-Arch with 15′ 10″ span, and rise of 9′ 10″. Six horizontal deflection angles were used to provide a 70° 15′ curve.

Installation was quick, economical, and efficient—with a minimum of disturbance to the city's daily routine. In addition to savings in time and money during installation, the structure will continue to pay dividends through years of trouble-free service.

Rome, New York's stream burial is but one of the many drainage problems which can be solved quickly and permanently by Republic Sectional Plate Pipe-Arch and other drainage products. To find out how these products can be used in your applications, simply contact the Toncan Drainage Products Manufacturer nearest you, or mail coupon at far right.



Manufacturers of Toncan Drainage Products

Bark River Culvert & Equipment Co.
Escanaba, Mich.

Beall Pipe & Tank Corporation
Portland, Ore. • Boise, Idaho

Bluegrass Pipe & Culvert Co.
Louisville, Kentucky

The Boardman Co.
Oklahoma City, Okla. • Tulsa, Okla.

Carolina Culvert & Metal Div. Florida Steel Corp.
Statesville, N. C.

Central Culvert Corporation
Alexandria, La.

Choctaw, Inc.
Memphis, Tenn. • Birmingham, Ala.

Dominion Culvert & Metal Corp.
Roanoke, Va.

Eaton Metal Products Corp.
Omaha, Neb. • Hutchinson, Kan.

Eaton Metal Products Company
Billings, Mont.

Empire State Culvert Corp.
Groton, N. Y.

Garland Steel Co.
Phoenix, Ariz.

Illinois Corrugated Culvert Co.
Bushnell, Ill.

Jansen Bridge & Supply Company
Sandusky, Mich.

H. V. Johnston Culvert Co.
Minneapolis, Minn. • Aberdeen, S. D.

Logansport Metal Culvert Co.
Logansport, Ind.

M & M Hiway Materials Co.
Columbia, Mo.

North Dakota Metal Culvert Co.
Fargo, N. D.

Northeastern Culvert Corp.
Westminster Station, Vermont

Pacific Corrugated Culvert Co.
Sacramento, Calif.
Temple City, Calif.

The Pedlar People, Ltd.
Oshawa, Ont.

Republic Steel Corporation
Culvert Division
Canton, Ohio • Harrisburg, Pa.
Charlotte, N. C. • Hammond, Ind.

Spokane Culvert & Fabricating Co.
Spokane, Wash.

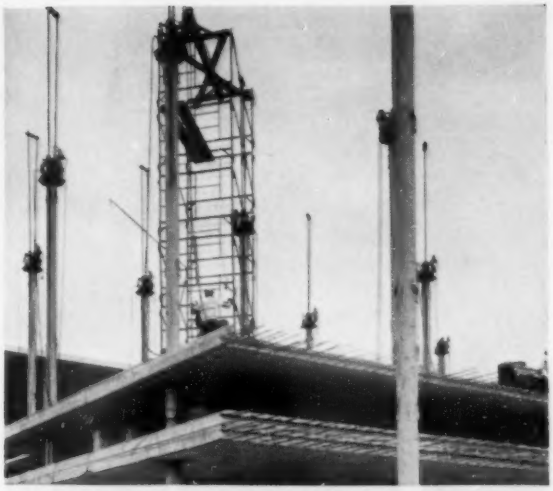
Thompson Pipe & Steel Company
Denver, Colo.

Tri-State Culvert & Mfg. Div. Florida Steel Corp.
Tampa, Fla. • Decatur, Ga.

Utah Culvert Company
Ogden, Utah

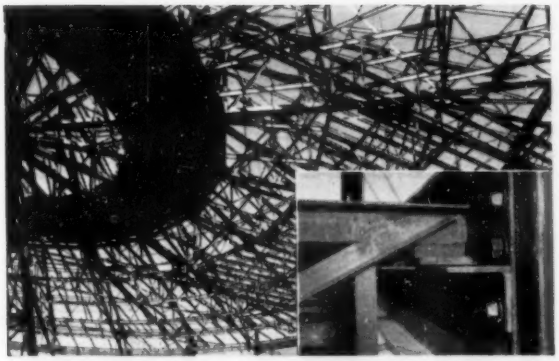
Wisconsin Culvert Company
Madison, Wis.

Wyatt Metal & Boiler Works
Dallas, Tex. • Houston, Tex.



TIME AND MONEY WERE SAVED when Republic Steel Pipe was used in erecting the Tremco Building, Cleveland, Ohio. Slabs were poured on ground, then gradually hoisted up 10¾-inch diameter pipe, by means of hydraulic screw jacks. Scaffolding, elevators, etc., were eliminated. Slabs were raised at a rate of 3′ per hour. Mail coupon for details on Republic Steel Pipe.

SAVINGS IN FLOOR SPACE, with support for heavy loads, were obtained by using Republic High Strength Concrete Reinforcing Bars in Washington National Insurance Company Building, Evanston, Illinois. Columns using 11 No. 18S butt-welded high strength bars, with a possible design stress of 30,000 PSI, measure only 26″ in diameter. Republic High Strength Reinforcing Bars provide a minimum yield point of 75,000 pounds per square inch and meet new ASTM Specifications A-431-58T. Mail coupon.



SAFE, STRONG CONNECTIONS are provided through use of Republic High Strength Bolts in dome of new Convention Arena, Detroit. High clamping force transfers loads to structural members by friction alone—an advantage that only high strength bolting provides. Installation is quick, easy, economical. Mail coupon for further details. (Giffels and Rossetti, Architects. R. C. Mahon Co., Structural Steel Contractor. General Contractor, O. W. Burke Co.)

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World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. PW-7872
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

☐ Corrugated Pipe ☐ High Strength Structural Bolts
☐ Steel Pipe ☐ High Strength Reinforcing Bars

Name_____ Title_____

Firm_____

Address_____

City_____ Zone____ State_____

R-C AIR BLOWERS, VACUUM PUMPS AND GAS METERS

Selected for Miami's $27-million Pace-setting Sewage Disposal Project

Eight years of preparation and three years of construction have given the City of Miami one of the most modern, integrated sewage disposal systems in the country. An overall pollution abatement program included the construction of intercepting sewers, pumping stations, a force main across Biscayne Bay, a treatment plant on Virginia Key, and an outfall extending nearly a mile into the ocean. The sewage treatment plant is a high-rate activated-sludge type with a designed capacity of 47,000,000 gallons per day, estimated to meet the city's needs until 1965.

In such an installation as this, where operation is continuous and largely mechanized, only the best, most reliable equipment will serve. In many areas throughout the plant where air or gas were to be handled, Roots-Connersville equipment was selected, because only R-C equipment could meet the exacting specifications. And only R-C equipment could deliver the kind of performance required in this service—dependable, around-the-clock operation with a minimum of maintenance. For no other manufacturer has had so many years of experience producing air and gas handling equipment for sewage treatment applications.

The R-C equipment selected for the Miami sewage treatment plant includes three rotary air blowers for grit removal, four rotary blowers for the aeration tanks, two rotary vacuum pumps for sludge dewatering, and five rotary gas meters for measuring sludge gas. All these units utilize the well known "Roots" rotary positive displacement principle to assure top performance for long years of service.

R-C blowers, pumps and meters such as these are available in a wide range of sizes and capacities to meet every standard or special application. In addition, Roots-Connersville produces centrifugal blowers and Spiraxial® compressors. All are backed by the unmatched reputation established by Roots-Connersville in more than a century of manufacturing air and gas handling equipment.

ROOTS-CONNERSVILLE BLOWER
DIVISION OF DRESSER INDUSTRIES, INC.
739 Poplar Ave. Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto

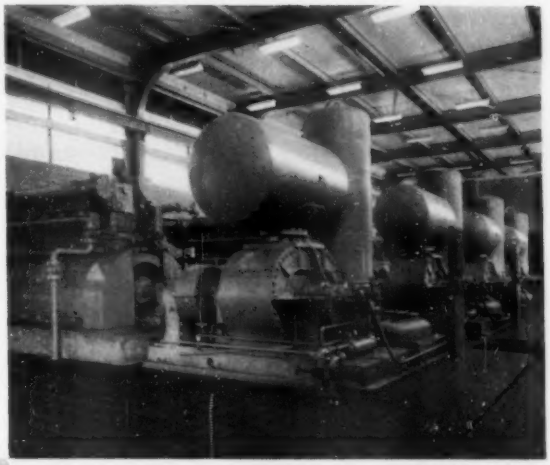
Additional data about Roots-Connersville equipment appears in **Chemical Engineering Catalog, Mechanical Catalog and Sewage Manual.** *Or write us for specific information about any problem in the handling of gas or air.*

CITY OF MIAMI
SEWAGE TREATMENT PLANT
MIAMI, FLORIDA

DEPT. OF WATER AND SEWERS, CITY OF MIAMI
C. F. Wertz, Director
Garrett Sloan, Chief Engineer
David F. Blackmeyer, Superintendent

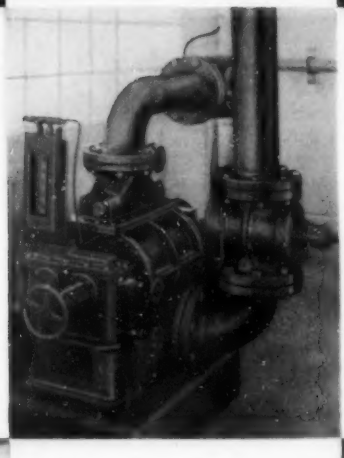
ENGINEERS
Metcalf & Eddy, Boston, Mass.

CONTRACTOR
Paul Smith Construction Co.
Tampa and Miami



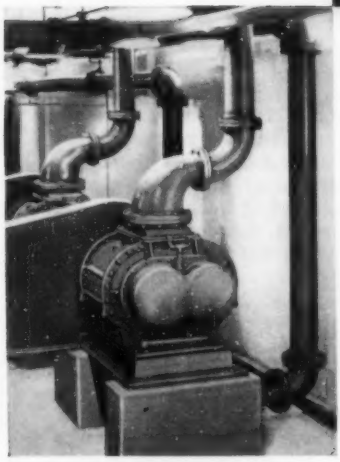
AERATION BLOWERS

Air for the aeration tanks is supplied by these four 24 x 28½ rotary positive displacement blowers of the two lobe type. Each blower has a capacity of 10,400 cfm at a discharge pressure of 7.5 psig and is driven at 514 RPM by a 410-HP engine. Two engines are dual-fuel engines and the other two are spark-ignition gas engines.



GAS METERS

R-C rotary positive displacement meters are used to measure the sewage sludge gas produced in the digestive process. This gas is supplied as fuel to the engines driving the aeration blowers. Illustrated is a 4 x 12 low-pressure meter handling 10,000 cfh of sewage sludge gas. Four other 3½ x 10 R-C meters are also used, each with a capacity of 6000 cfh.

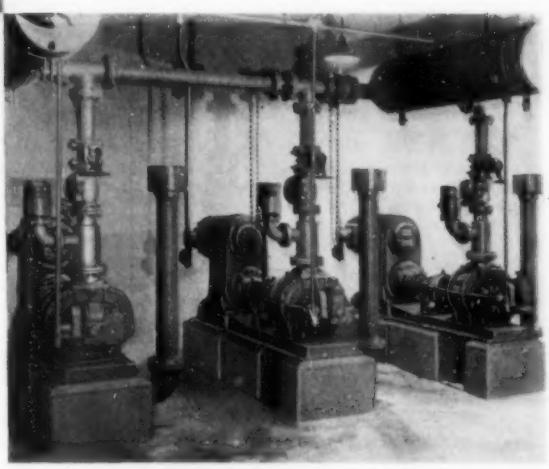


GRIT CHAMBER BLOWERS

In the grit chambers, these three R-C rotary blowers supply air to remove grit from incoming raw sewage. Each unit is an 8 x 8 blower driven at 320 to 640 RPM by U.S. Varidrive, discharging against 7 psig. The blowers furnish up to 6.3 cubic feet of air per lineal foot of tank when all three blowers and two tanks are operating.

VACUUM PUMPS

After elutriation, sludge is dewatered. These two 14 x 21 rotary blowers are used as dry vacuum pumps on dewatering filters. Each pump has a capacity of 1,630 cfm and provides a vacuum of 12 to 15 inches Hg., referred to a 30" Hg. barometer, when operating at 415 RPM.



Dodson's Digest

Movietime

"There's an old Dennis Morgan movie playing at the drive-in theatre and we're going to see it *tonight*."

That was my wife talking and that's how we happened to be at the movies one night about two weeks ago.

We had just settled down to enjoy the picture when a terrific gust of wind whipped across the drive-in, flinging up a cloud of dust that swept right through our car! We coughed and sputtered and finally got all the dust out of our eyes. After shutting the windows, I decided to have a chat with the manager.

I found him looking very glum and very dusty, indeed. "My name's Dodson and I . . . "

"And I suppose you want *your* money back, too," he shot back.

"Well, you couldn't blame me if I did."

"I suppose not. But what do you want me to do? I'm going to pave the place when I get enough money together, but the way I've been losing customers because of this dust, I'm liable to be out of business before that happens."

"Not if you use Calcium Chloride."

"Use what?"

"Calcium Chloride. State and county highway departments use it to keep their unpaved roads free from dust. It hardens the surface, prevents chuckholes, and . . . "

"Sounds good. I might look into it."

"As a matter of fact, I happen to know a very good source." I smiled and handed him my card.

We shook hands, and I fought my way back to the car amid flurries of dust. As I climbed in, the title flashed on the screen and I laughed aloud. It was *The Desert Song*. Say—there's a real market for Calcium Chloride!

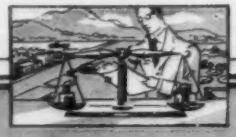
—L. D. Dodson

P.S.—For valuable tips on how to solve *your* dust problems with Wyandotte Calcium Chloride, write me for your free copy of our leaflet, "How To Stop Bothersome Dust." *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*

Wyandotte CHEMICALS

MICHIGAN ALKALI DIVISION

HEADQUARTERS FOR CALCIUM CHLORIDE



LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Establishment of Town Roads

Lieser v. Town of St. Martin, 96 N. W. 2d. 1, a Minnesota case decided April 3, 1959, was a proceeding on a petition to establish a town road.

The petitioners, Lieser and Spanier, filed their petition with the town boards of the towns of St. Martin and Zion in Stearns County, Minnesota for the establishment of a town road on the line between the two towns. The petition was not approved by a majority of the members of the two town boards and the petitioners appealed to the district court from the determination. The jury was asked to answer the following interrogatory:

"Did the Town Boards of the Towns of St. Martin and Zion . . . act arbitrarily, oppressively or fraudulently and against the best interests of the public in denying the petition for the establishment of the road in question?"

The jury answered the question in the affirmative, and the Town of St. Martin appealed to the Supreme Court of Minnesota.

When the two boards met for a hearing on the petition, the members personally examined the route of the proposed road, from one end to the other, interviewing landowners and interested parties in the vicinity adjacent to the proposed township road. With price lists in their possession, they examined and determined the number, size and cost of all culverts required and the cost and size of one bridge which would have to be built across a stream traversing the dividing line between two towns, in case the two boards should jointly determine to establish the proposed road.

The members of the two boards, with a member of the township of Zion acting as chairman, heard all parties in favor of or opposed to the granting of the petition. All persons present at the meeting who wanted to be heard were heard.

The gross figure, as the probable cost of the proposed road, arrived at by the boards was from $19,604.25 to $20,658.60, which included only $800 for land that would have to be taken.

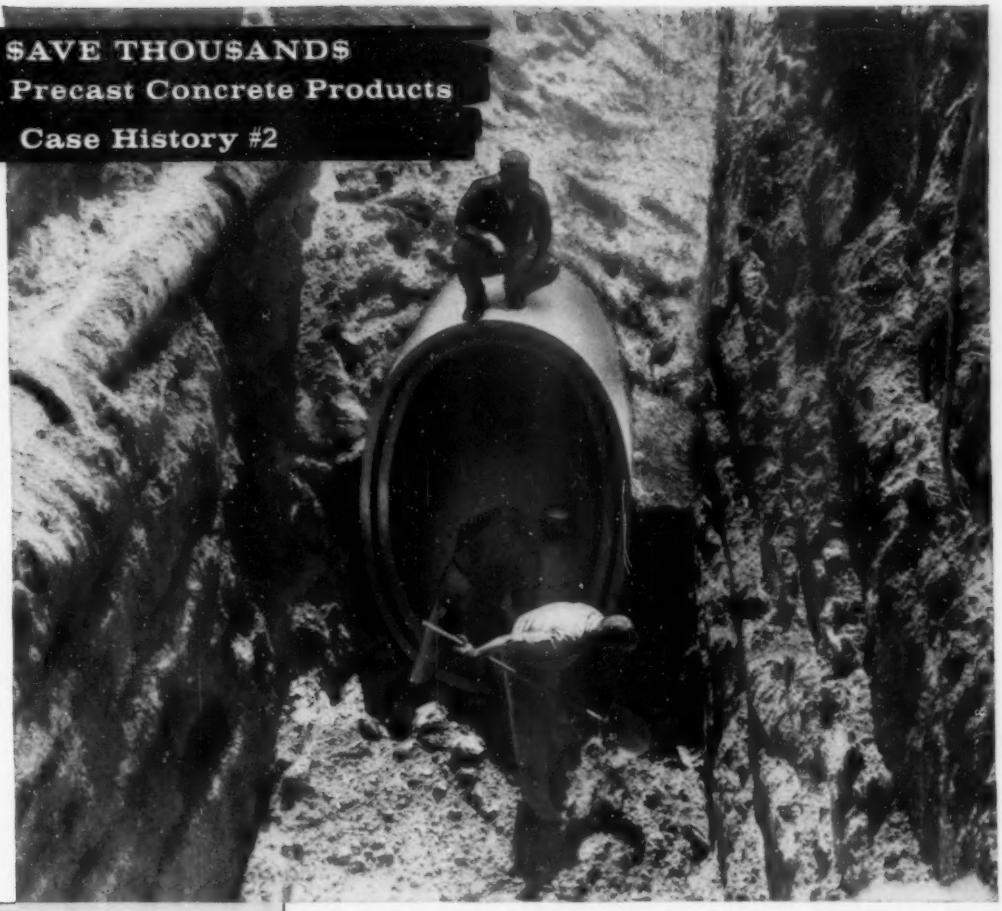
The members of each town board, after completing their deliberations, acted separately on the petition. When the result of their combined vote was announced, it appeared that all the members of the Zion town board voted in favor of granting the petition and all of the members of the St. Martin town board voted in opposition to it.

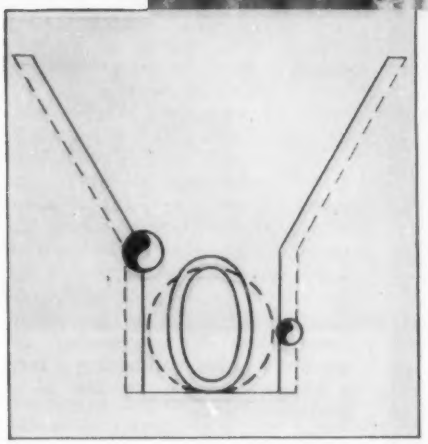
Neither town had funds to pay its proportionate share of the cost of establishing the proposed road and it would have been necessary for both towns either to float a bond issue or to secure the money in some other way.

The farm of the Liesers is located in sections 4 and 5 of the town of Zion, their farm buildings being in the northeast corner of section 5. There are two roads extending from their buildings to a township road; one of which extends to the east across the creek to the township road on the east side of the section, a distance of 0.4 mile. From the town road on the east the Liesers in traveling to the village of St. Martin travel to the northeast corner of the section and thence to St. Martin. Besides, the Liesers have a road extending to the west to the town road on the west line of section 5 which is 0.6 mile from their buildings. From that point they can travel south to the county-aid road as a matter of choice and they can travel along the west line of section 5 to the existing town road across section 32 in the town of St. Martin.

The Spaniers reside in section 6 in the town of Zion about a mile

INCHE$ $AVE THOU$AND$
with A-M Precast Concrete Products
Case History #2





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- 18% narrower than equivalent round pipe, HI-HED Pipe cuts valuable inches from trench widths—can save contractors thousands of dollars in excavation costs.
- HI-HED saves customers the expense of removing or relocating utility lines.
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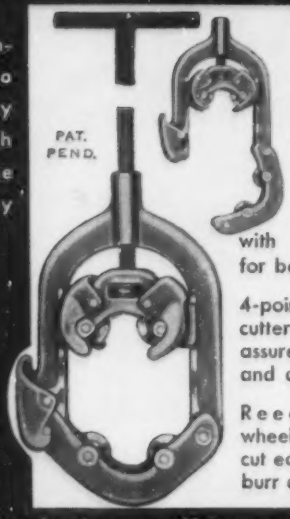
IF YOU CUT LARGE DIAMETER PIPE . . .
YOU NEED THESE
New REED HINGED 4-WHEEL PIPE CUTTERS
Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

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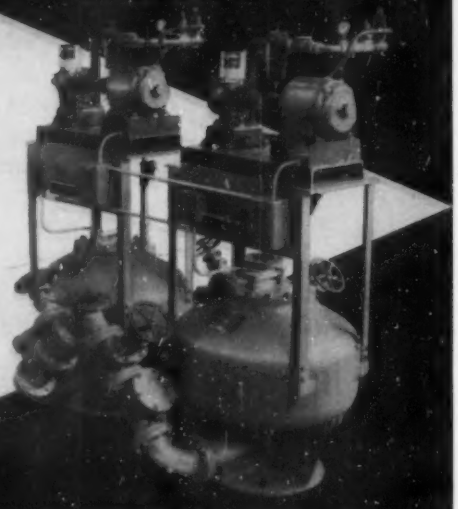
Komline-Sanderson service, putting to work the practical experience gained in hundreds of sewage handling installations all over the country, stands back of every K-S Sewage Ejector System.

Sizes available from 30 to 600 GPM capacities—single or duplex. Construction; cast iron or steel. Controls; pneumatic or electrode.

Write for 14 page catalog No. KSM-2



MECHANICAL EQUIPMENT DIVISION
KOMLINE-SANDERSON ENGINEERING CORPORATION
101 Holland Avenue, Peapack, New Jersey

west of the Lieser farm. In going from their farm buildings to St. Martin they can travel to the east to the town road on the section line between sections 5 and 6, and then either north to the town road across section 32 or to the south to the county-aid road. The existing town road crossing the town of St. Martin and maintained by it is an all-season road. Snow removal is provided in the winter and it is open to travel the year around whenever other nearby roads in the vicinity are open to travel. There are also connecting roads that run into the village of St. Martin.

The Supreme Court of Minnesota held, upon consideration of all the factors involved, that the jury should not have been allowed to answer the interrogatory. As a matter of law, it was held, there was nothing arbitrary in the action of the Town Boards, and their decision not to establish the road was upheld.

When Waters Run for Cover

Cover v. Platte Valley Public Power & Irrigation District, 95 N.W. (2d) 117, a Nebraska case decided Feb. 14, 1959, was an action by a landowner against an irrigation district for damages caused by the flooding of his land.

In a previous case, the Supreme Court of Nebraska had held that the district was negligent in providing an undersized drain from a drainage canal. In the present case, the district had won in the trial court, on the ground that the flooding was actually caused by an Act of God (that is, *direct* flow of floodwaters onto the plaintiff's land, rather than from the district's canal). However, it was held that even though the land elevations were such that *some* floodwaters may have reached plaintiff's land directly, the district was liable nevertheless for *increasing* this amount, and for maintaining it there a longer time on account of its inadequate drain.

Weed Control and Removal

Boards of town trustees of any town in Indiana now have power and authority to require owners of real estate within such town to remove weeds and rank vegetation. If the owner fails to remove same, the town shall have authority to remove the weeds and vegetation. If the land owner does not pay for such work performed by the town, the cost of the work shall be placed on the tax duplicate.

How the powerful pull of a magnetic meter drive benefits you

This simple diagram demonstrates how the driver magnet (shown in hand) revolves around a watertight compartment at the base of the register. This compartment encloses the follower magnet which pushes a crankshaft to transmit every motion of the piston to the sealed reduction gearing.

With this construction there's no stuffing box to leak or bind. The register, kept clean and dry in its hermetically sealed case, is always operative—always fog free and easy to read. And in this revolutionary meter there are *only two moving parts* in water. It's truly the *least vulnerable* meter ever—the easiest, quickest and most economical to repair. For a descriptive bulletin, write Rockwell Manufacturing Company, Pittsburgh 8, Pa.

SEALED REGISTER METERS

another fine product by

ROCKWELL

Don't just eye it, try it!

The only water meter with a powerful magnetic drive . . . the only meter with a hermetically sealed register . . . the only meter without a stuffing box . . . the only meter with but two parts operating in water.

Revolutionary ***MAGNETIC DRIVE***

ROCKWELL Sealed Register **WATER METERS**

Barber-Greene Model 879-B—the universal finisher for any size job—shown paving street for housing development. Write for information on this famous finisher.

The asphalt finisher for all jobs large or small

. . . Barber-Greene 879-B

With introduction of the Model 873 finisher, which paves on crawlers and travels on rubber—and with the recent Barber-Greene announcement of two new heavy-duty finishers for the ultimate in high-capacity, continuous operation—there have been many questions about selection of the *right* finisher.

Whatever the job, the new, improved Barber-Greene Model 879-B is the universal asphalt paving machine. Unmatched for jobs of all types and sizes, this famous finisher is the paving standard of the world. Its exclusive tamping-leveling principle gives unequaled mat quality while laying any asphalt mix. New improvements include: 25% more power, new transmission, 60% greater hopper capacity, 45% faster paving speed, faster travel speed, new tamper design, improved screed for longer life, and new crawler design.

FOUR DIFFERENT FINISHERS

Model 873—paves on crawlers . . . travels on rubber. Designed for scattered jobs, from driveways to highways.

Model 879-B—the universal finisher for all types and sizes of jobs.

Models SB-60 and SA-60—pneumatic-tired or crawler-mounted — heavy-duty, high-capacity, high-speed machines.

59-11-F

These are just the high spots. Ask for complete information on all four.

Barber-Greene BG

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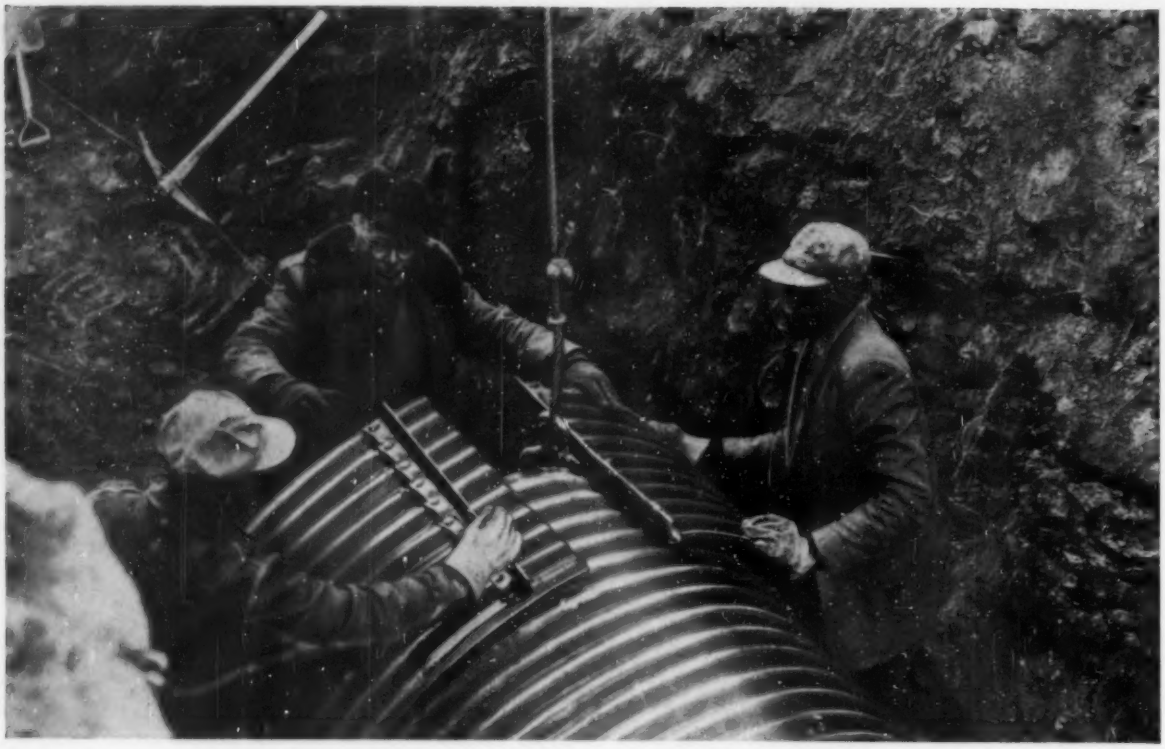
CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT



Even large-diameter lengths of Beth-Cu-Loy pipe are easily and quickly joined.

How to Join Lengths of Corrugated Galvanized Beth-Cu-Loy Pipe

One of the many advantages of pipe fabricated from galvanized Beth-Cu-Loy sheets is the simplicity of connecting the lengths. Here's all there is to it:

1. Slip a standard connecting band over the end of the first pipe section, with the band open to receive the second section.

2. Move the second section to within one inch of the first section, and tighten the bolts on the collar of the band. Be sure the corrugations of the band nest into those of each length of pipe.

3. Keep dirt and gravel out of the space between coupler and pipe. Draw up bolts or nuts uniformly, tapping the band with a mallet as the tightening proceeds.

4. With paved pipe, take care to align the paving of each pipe with its neighbor.

Drainage structures made of galvanized Beth-Cu-Loy sheets are strong, light in weight, flexible, and durable enough to last the life of the project. Bethlehem manufactures the Beth-Cu-Loy sheets to the rigid specs of the AASHO. Your fabricator will give you full details on Beth-Cu-Loy pipe; if you wish, we will send you the name of a fabricator near you. Just drop a line to our nearest office.

A crescent wrench and C-clamp are only tools required to secure connecting band to pipe sections.

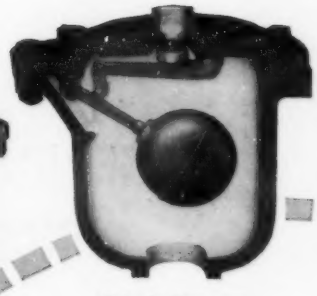
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

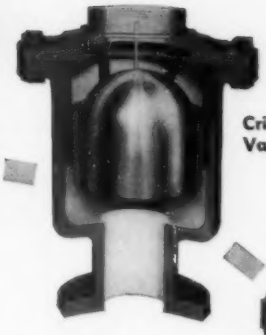
BETHLEHEM STEEL

BETHLEHEM STEEL

Crispin Midget Valves

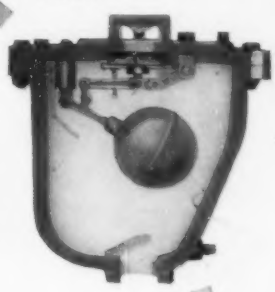


Crispin Pressure Valves



Crispin Air & Vacuum Valves

Crispin Universal Valves



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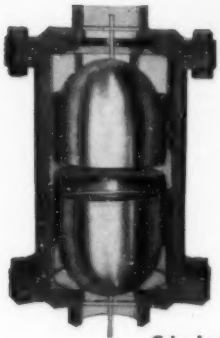
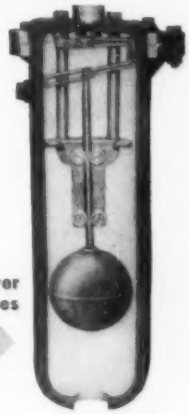
AUTOMATIC AIR VALVES

... preferred by works engineers for over 45 years



Crispin Negative Pressure Valves

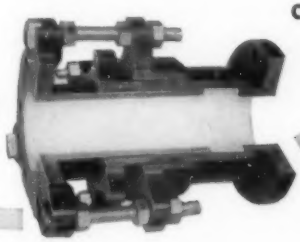
Crispin Air Valves safely control air in lines handling liquids to maintain efficient operations—prevent expensive failures. Simplified construction, easy accessibility, maximum durability, minimum maintenance and efficient operation are five solid reasons why Crispin Air Valves are completely dependable.



Crispin Sewer Valves

Crispin Deep Well Valves

Crispin Slip Joint



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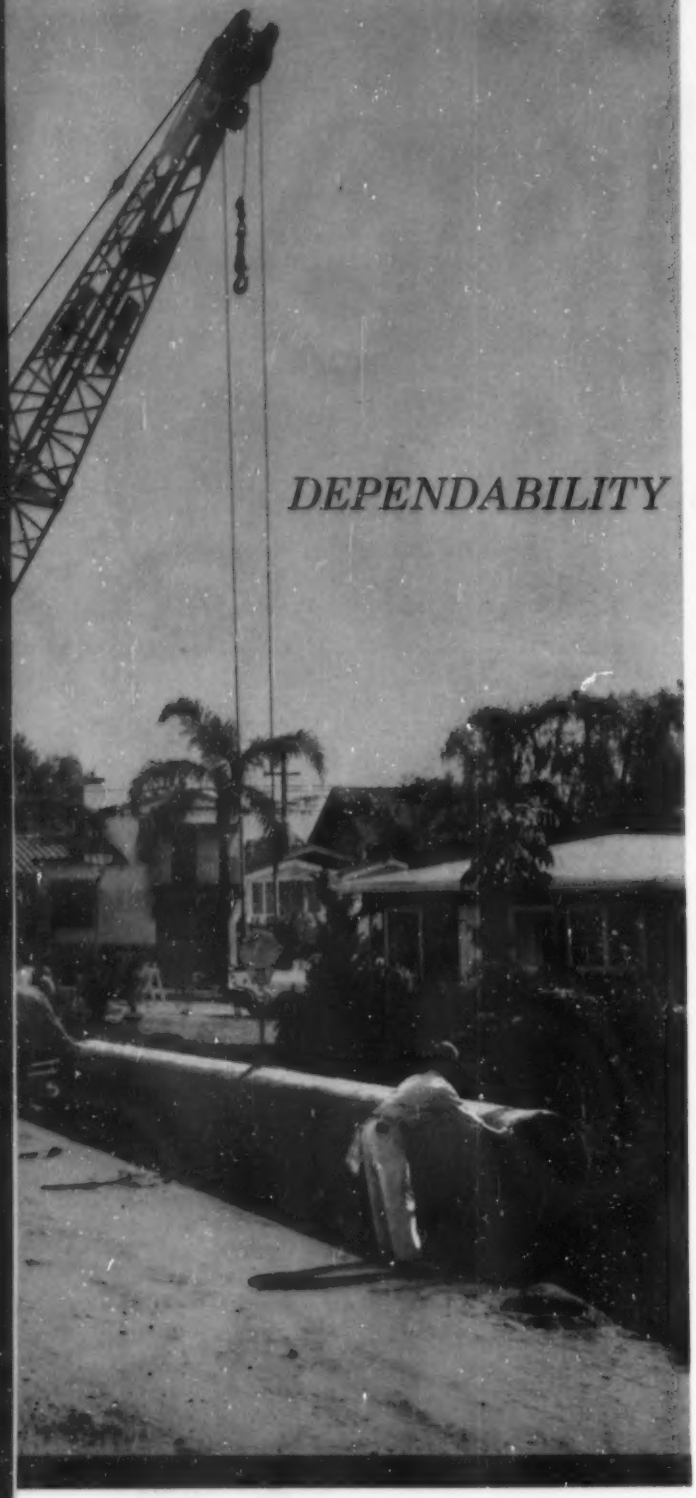

AMERICAN CONCRETE CYLINDER PIPE *provides...*

DEPENDABILITY with ECONOMY

This pretensioned concrete cylinder pipe embodies all of the qualities and characteristics sought by water works engineers for permanent water supply and transmission lines—strength, sustained high carrying capacity; trouble free service and unusually long life. Its competitive initial cost has made it possible for hundreds of water works agencies throughout the West to obtain these desired qualities for pipelines with pressures generally ranging from 100 psi upward, and requiring diameters of 10" through 60" (or in many cases larger, where specific project conditions permit). When you select pressure pipe for your permanent water "growth lines," be sure to investigate American Concrete Cylinder Pipe, a superior product with an outstanding record of acceptance.

A. The steel cylinder provides a positive water seal or membrane as well as part of the total steel area required for internal stresses.

B. The smooth centrifugally applied mortar lining of at least ¾" thickness provides positive internal protection, sustained hydraulic capacity, and, **imparts rigidity and strength through "arching effect."**

C. Steel reinforcement rods, which together with the steel cylinder provide the total cross-sectional steel area required for the operating pressure specified, are wound under controlled tension and accurate spacing around the concrete lined cylinder, placing it under moderate compression.

D. In conjunction with the steel rod reinforcement along the entire surface of the cylinder, the application of a dense concrete coating produces, in effect, a **reinforced jacket** which affords additional structural strength as well as positive exterior protection.

The 32-foot long pipe sections are easily installed with standard equipment using a single cable sling. In addition to providing a watertight seal, the rubber gasketed joint facilitates ease and economy of installation, and eliminates the need for caulking or field welding.

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CONCRETE PIPE FOR MAIN WATER SUPPLY LINES. STORM AND SANITARY SEWERS. SUBAQUEOUS LINES

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the ONE FORTY FIVE— OUTSTANDING VALUE IN MEDIUM-POWER GRADERS

80 hp 21,540 lb

. . . with features you can't match for the money on any grader

The new Allis-Chalmers ONE FORTY FIVE motor grader is built to outwork and outproduce any grader near its size...at a price you can't afford to overlook. An exclusive combination does it: high capacity front axle and throat clearance, big-grader power train, ROLL-AWAY moldboard, plus benefits that help an operator to do more work.

The ONE FORTY FIVE power train is built for long, hard grading service. Simple, dry-type, ceramic-lined clutch; constant-mesh transmission; heavy-duty gear train—all much stronger than you usually find in a grader this size.

Measure the big clearance under the front axle. It straddles huge windrows without drag. Watch the ROLL-AWAY moldboard lift and roll the load. Check the load-clearing height from cutting edge to circle. You'll get more grading production, more oil-mix ability than any other medium-sized machine can give you.

Now check the ONE FORTY FIVE'S production-boosting operator advantages. Platform is clean and roomy. Suspended pedals provide matchless foot room. Full visibility all around takes the strain out of operating. Toggle-type control levers work with quick response . . . allow ample road feel without wrist-snapping backlash.

You be the judge. Your Allis-Chalmers dealer will show you an eye-opening demonstration of the ONE FORTY FIVE. Then keep its low cost —and high performance—in mind when you write *your* specifications. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.

ROLL-AWAY is an Allis-Chalmers trademark.

move ahead with ALLIS-CHALMERS

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REMOTE SUPERVISORY CONTROL OF PUMPING STATIONS

BRUCE J. ENNIS
Principal Engineer,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

MANY water distribution systems are so situated geographically and arranged hydraulically, that it is not possible to confine all pumping units in a single location, such as at a central filtration and treatment plant. Sometimes, the location of the raw water supply at a lake, on a river, or in a well field does not lend itself to the proper design and layout of a filter plant, making it necessary to install a raw water pumping station at a considerable distance from the finished water pumps in the treatment plant.

As water usage increases in urban areas, and residual pressures fall below minimal standards on high ground or at the extremities of the water distribution system, it is frequently necessary, or economically desirable, to establish booster districts which, again, require the installation of booster pumping stations remote from the central filtration plant.

When such auxiliary pumping stations are required, it is necessary to provide either: (a) an operating staff in each station to control the starting and stopping of pumps, the opening and closing of valves, the surveillance of the temperatures of the pump motors, etc.; or, (b) an electric control system to provide these functions remotely from a common control center in the filter plant.

Obviously, unless the remote pump station is of considerable size and importance, it is not economical to employ individual staffs of operating personnel for each such station. For the smaller pumping stations, which do not warrant separate staffs of operators, it is more feasible to install a remote control system to operate the stations electrically from a central point.

If the auxiliary pumping station is only a few hundred feet, more or less, from the system control center, it is possible to install multiconductor control cables from each pump motor controller and valve operator to its respective control switch. With normal control wiring, this will require four or five conductors for the start-stop and indicating lamp functions for each pump or valve unit. Multiplied by the number of such units to be controlled, the cost of such an interconnecting control cable system is acceptable for short distances; however, for longer distances, individual controller wiring between pump motor starters or switchgear and their corresponding control switches is not feasible from either a technical or economical standpoint.

In this latter case, the preferable method for controlling isolated pumping stations is through the use of a supervisory control system containing equipment for the selective control and automatic indication of remotely located apparatus over a pair of telephone-type conductors. Generally speaking, such a system operates in a manner similar to a dial telephone system. At the central control station, such as at the filter plant mentioned above, a "controlling" switchboard is installed which contains groups of control switches, indicating lamps, and telephone-type relays. At the remote pump station, a "controlled" switchboard is installed which contains telephone-type relays and interposing relays to transfer the control operations from the telephone-type relays to the control power circuits of the equipment being controlled. The "controlling" and the remote "controlled" switchboards are interconnected by a single pair of conductors.

Operation

In operation, pushing a "start" button for Pump No. 1 (for example) in the controlling switchboard in the filter plant actuates a specific sequence of telephone relays in the switchboard to send a corresponding series of impulses over the pair of conductors to the remote pump station, where the impulses, acting on the telephone relays in the controlled switchboard, operates a definite sequence of such relays to energize, through the associated interposing relay, the starting control circuit for Pump No. 1.

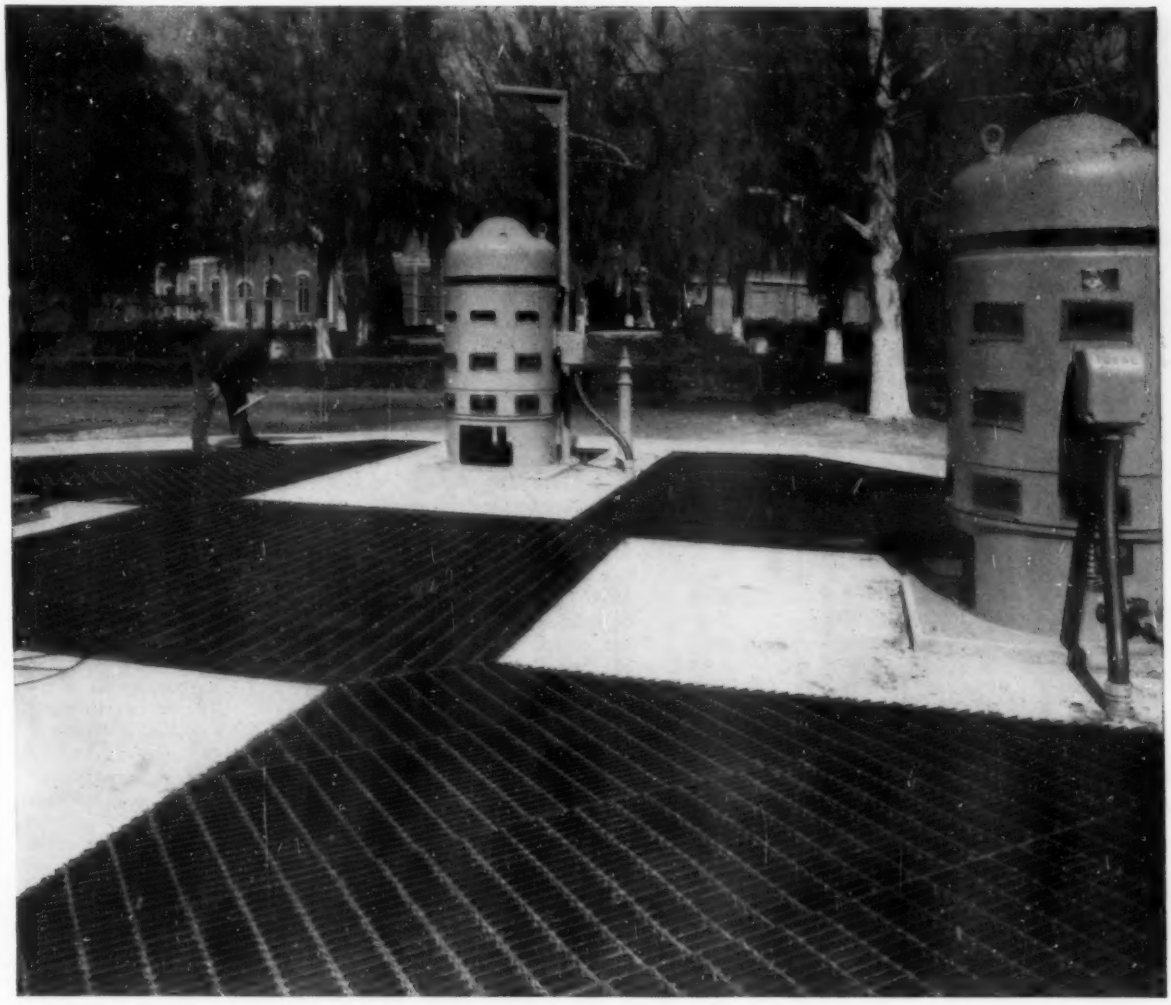
In turn, the auxiliary switches in the motor starter for Pump No. 1 automatically actuate telephone relays in the controlled switchboard to send impulses back to the controlling switchboard where they actuate associated relays to change the control station lamp indications to correspond to the new running condition for Pump No. 1, and so on. Such control functions may be obtained through the use of supervisory control system of either the impulse type or of the audio frequency type.

Supervisory control equipment may be provided to control selectively any number of units of apparatus in one or more outlying stations over a single pair of conductors linking the remote stations with the central control point. The supervisory channel can be used for telephone communication between stations as well as for selective intermittent telemetering readings of liquid levels, hydraulic flow, voltages, currents, kilowatts, valve positions and other readings which the remote operator may need as a guide for his operating procedure. Continuous telemetering readings used for totalizing purposes require separate metering channels.

Specifications

In preparing specifications for the purchase of a supervisory control system, certain design and operating criteria should be specified, similar to the following:

(1) Each selection to be automatically checked before it is possible to proceed with any control operation.
(2) Continuous individual lamp indications of each remote device unit.
(3) Positive, anti-pumping control.
(4) Only a single channel required over which a number of remote stations may be operated.
(5) Freedom from improper opera-



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tion due to foreign voltages on interconnecting channel line wires.

(6) Supervision of line wires (for automatic alarm against open or shortcircuiting).

(7) Equipment to be normally at rest (impulse type of control).

(8) Fast operating (the time required to select, control and register an operation should not exceed 3 seconds).

(9) Any number of operations may be made on device controlled without the necessity of reselection.

(10) Telemetering for intermittent readings can be on same point which controls a breaker, motor starter, or valve operator.

(11) If a circuit breaker (or other remote alarm contact) trips, an alarm lamp will flash automatically and a bell will ring at the controlling station until silenced by pushing the "alarm" button. The system shall indicate which individual device is operating the alarm.

(12) If several alarm indications occur simultaneously, they will all report to the controlling station, one at a time.

(13) Only one point may be selected at a time at the controlling station.

(14) A selected point may be released at any time by pushing the reset push button.

(15) Individual and automatic selection of all points shall be provided for checking indications of the entire station.

(16) Control panel designs shall include space and other necessary provisions for possible future control points to be added as the pump stations are expanded or developed more fully.

Automatic Alarms

In order to give the operator in the central control point a complete picture of the condition of an outlying, unattended pumping station, it is desirable to incorporate automatic remote alarm indications into the supervisory control scheme for the following functions:

(1) High temperature and low oil levels on power transformers.

(2) Under voltage potentials on pump motor switchgear buses.

(3) High temperature alarms on all pump motors, individually connected, or group connected to a single alarm bus, (using remote bulb thermostats attached to the motors with the bulbs subjected to highest motor temperature, as the alarm initiating contact device).

(4) Other functions peculiar to the pumping station being controlled.

The two-wire supervisory channel connecting the controlling station with the controlled stations should be of the leased telephone pair conductor type, for maximum reliability. However, the two conductors could be, as well, of open line wire type, or use could be made of carrier current or microwave channels. Using a two-wire standard No. 19 telephone wire metallic conductor type of channel, transmission distances should not exceed 30 miles for 48-volt d-c control, nor 60 miles for 125-volt control.

Open line wires, if supported on the same pole line with high voltage power lines, should be protected with insulating transformers and lightning arresters against inductive pick-up, possible contact with the power line conductors, and direct or induced lightning strokes.

Supervisory control systems offer a very valuable method for the centralization of controls of outlying pumping stations, with corresponding economic advantages depending on the size, complexity, arrangement, and location of the various components of the water distribution system. Whenever a new pumping station is to be constructed, or plans are contemplated for the rehabilitation of an existing system, consideration should be given to and studies made of the possibility of using supervisory control for increased flexibility of operations, improved dispatching of water pumpage to fit daily demand fluctuations, and additional economy in the operation of the water distribution system.

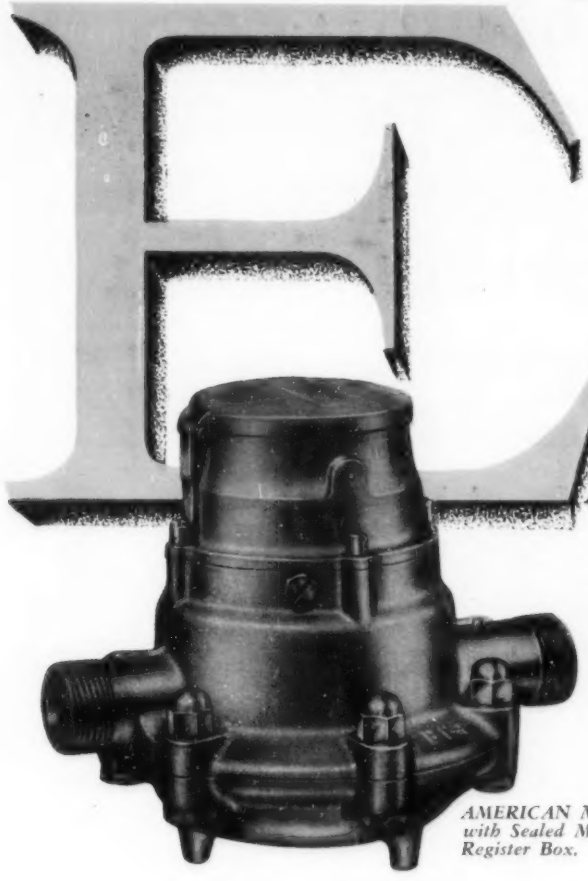
• • •

Parade of City Equipment

On May 2, 1959, the City of Hackensack, N. J., had its annual inspection and parade of the city rolling equipment. This annual affair gives the citizens of the city a chance to see what equipment is available and the condition that it is in. Some of the equipment that was in the parade is listed as follows: Three street sweepers; two LoDals; a leaf collector; six refuse trucks and one Dumpster; a snow loader; a front-end loader; a roller; two graders; a trencher; three dump trucks; and numerous other cars, station wagons and trucks. Harold V. Reilly is the City Manager and Joseph J. Squillace, is the Administrative Assistant of Hackensack.

AMERICAN METERS

HAVE WHAT THE WATER SUPERINTENDENT WANTS



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Plain black figures on a pure white background make AMERICAN METERS easy to read, even in dark pits. When desired we can furnish a solid metal register box with heavy ¼ inch thick crystal-glass top. This sealed box is free from condensation or moisture and the crystal-glass is non-fogging.

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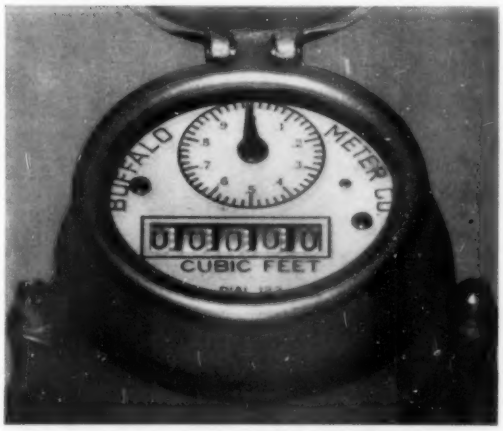
Yes, the AMERICAN METER register face is the answer to the Water Superintendent's request for Easy Reading!



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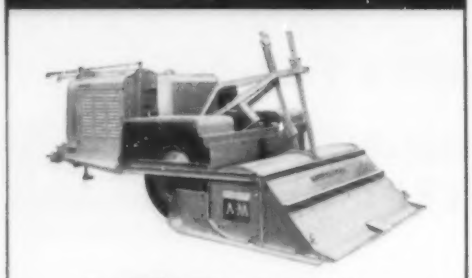
The **STĀ-BILT** Self-Propelled Mixer equipped with pump, tachometer, volumetric meter and spray bar.



The **STĀ-BILT** Pull-Type Mixer

The **STĀ-BILT** Self-Propelled Mixer

80% of all units used in stabilization are STĀ-BILTS. That fact is shown in an impartial market survey. There are plenty of good reasons — "plant mix quality at road-mix cost;" absolute control of aggregate segregation; high daily production of mixed and blended materials (up to a mile a day of 22 foot road) — all at low operating cost.

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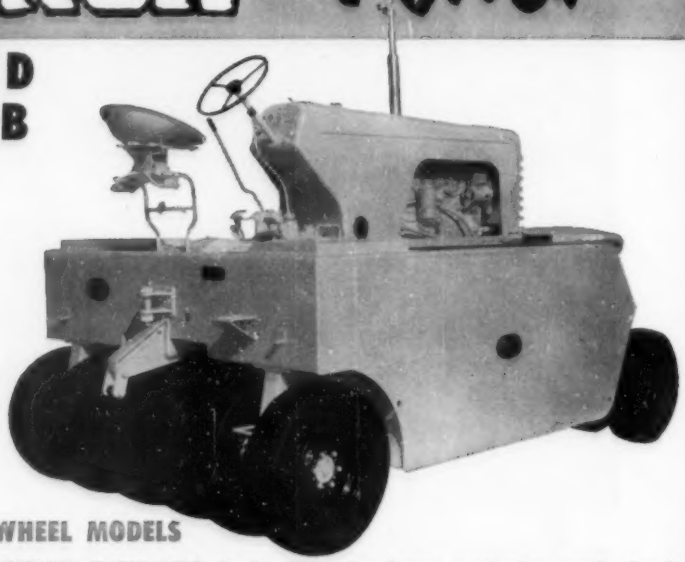

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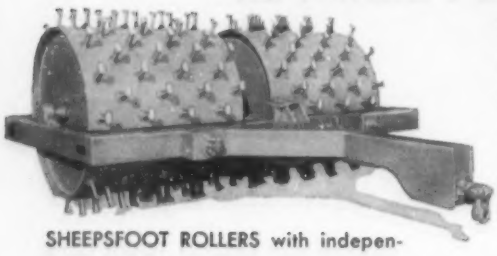
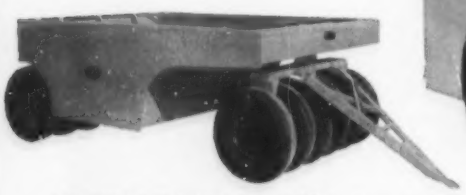
SELF PROPELLED PNEUMATIC tired rollers give faster production results for finish ing rolling, base work, seal coats and asphalt mats. Uniform wheel loads an kneading action of the tires give uniform densities and smooth surfaces.

TAMPO pneumatics have the fastest reversing cycle—automatically—with singl lever control.

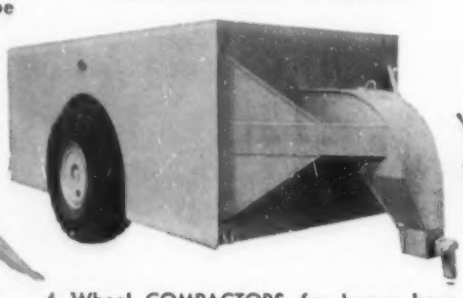
TAMPO pneumatics have completely equal wheel loads, absolute visibility an every comfort for the operator.



SHEEPSFOOT ROLLERS with independent drum oscillation. Size and type for every need.



PNEUMATIC TIRED ROLLERS in towed type design. 9, 11 and 13 wheel models.



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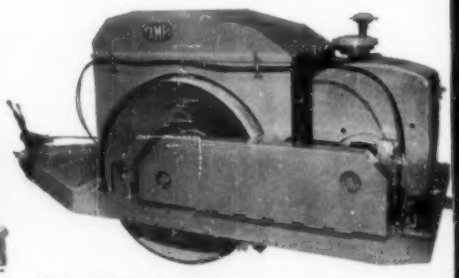

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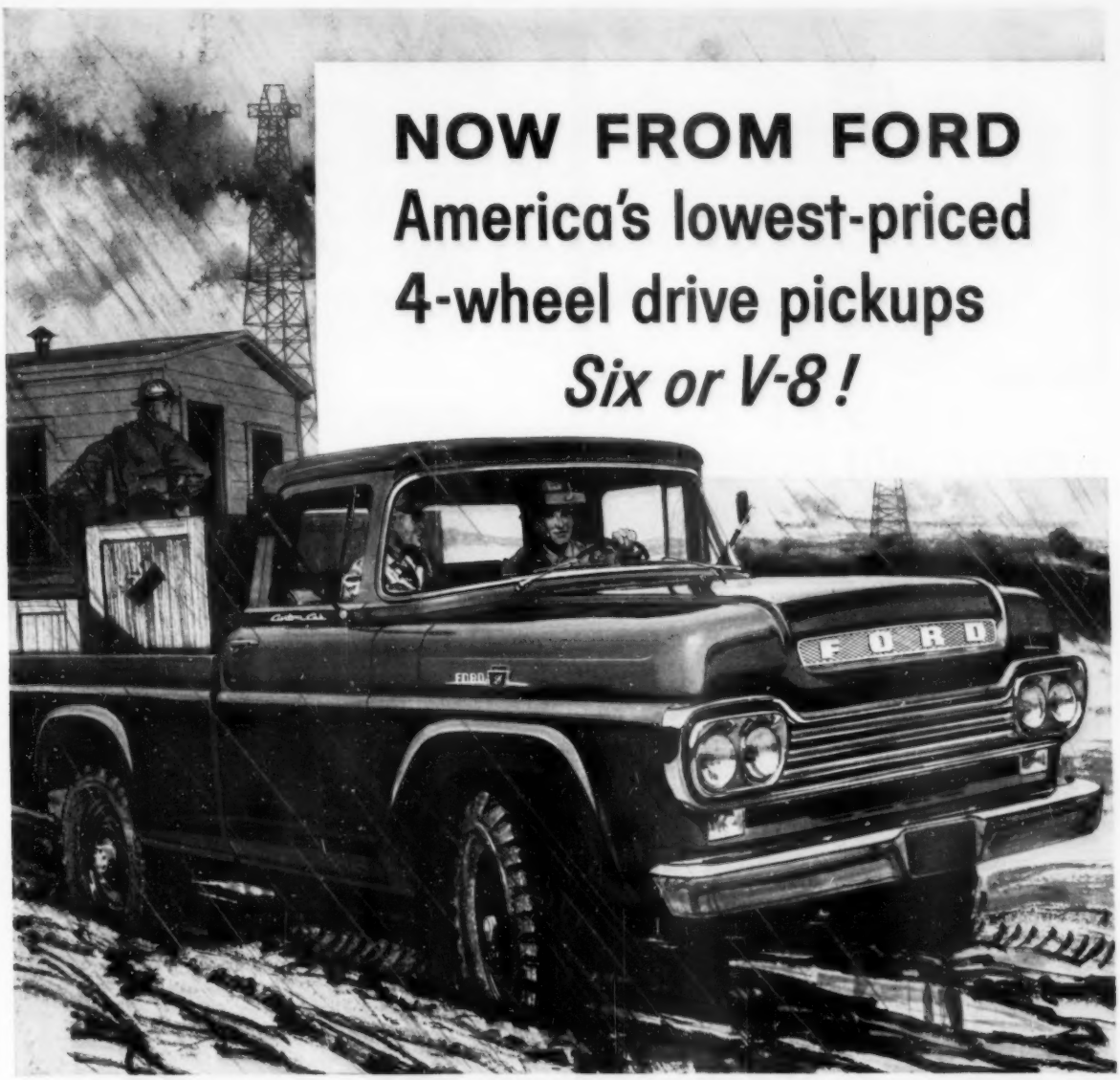

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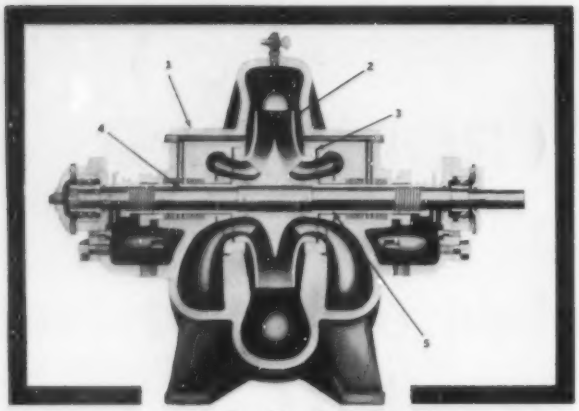

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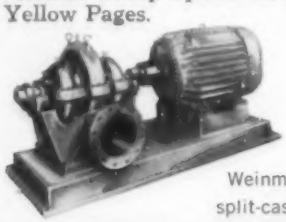

Weinman horizontal split-case pumps are available with capacities to 4000 GPM.

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CENTRIFUGAL SPECIALISTS

Commentary
on
Water and Sewage Treatment

SEDIMENTATION TANK EFFICIENCY

R. S. RANKIN

Consultant, Water and Sewage Treatment

SEDIMENTATION is now one of the most important and most frequently used operations in sewage treatment, yet the performance of primary units in particular is still unpredictable and often at variance with expected results despite all the theories developed to explain the process and assist the designer. Performance comparisons likely will show little overall change from two or three decades ago. Removal of suspended solids continues to be an erratic or inconsistent operation in many plants. One of the basic reasons for this situation, of course, is the variable characteristics of the raw sewage but possibly other factors, often overlooked, may account for some of these vagaries and even show that sedimentation units are doing a better job than the records indicate.

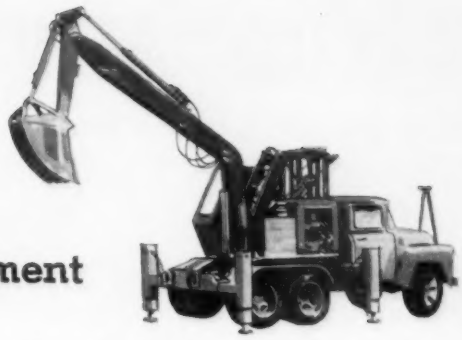
Requirements of governing authorities for primary tanks now stipulate overflow rates of 600 to 800 gal. per sq. ft. per 24 hrs. and minimum depths of 7 to 8 ft. These values when combined automatically establish a minimum detention period from 1.5 to 2.4 hr. The use of overflow rate in primary tanks is of recent origin although it has been used in the design of final tanks in activated sludge since around 1919 when the published operating results of the Milwaukee experimental plant included this yardstick. Hazen's often quoted experience showed that area was an important factor in the settlement of discrete or free settling particles and this principle has been applied to grit chamber designs for 30 years. Industry has likewise used overflow rates for decades in the proportioning of settling tanks but their application to primary settling in sewage plants is comparatively recent.

In 1931 the writer presented a paper on settling tanks which included this statement: "In raw sewage sedimentation, it appears that tank area as well as detention period has a definite effect and for best results settling rates of not over 600 and preferably 400 gal. per sq. ft. per 24 hr. should be used." In 1940 overflow rates began to appear in tank designs where high rate filter recirculation increased the hydraulic load on primary or secondary units. Since then they have gradually been recognized as one of the criteria to apply in the design or operation of any sedimenta-

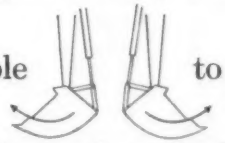
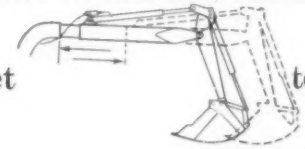
This is a

HYDROCRANE

...with a Hydrohoe attachment



and you can bet it's going to DIG because behind the teeth on that bucket is a combined total of 189,000 pounds of ram force! This machine has a combination of features that put it in a class by itself among half-yard hoes.

Here's why: The dippers for Hydrohoes, ranging from 24 to 60 inches wide, are reversible  to give you two-way digging action. Also, the dippers have hydraulic wrist action to bite in fast and hard. The boom on this hoe telescopes 4 feet  to give you efficient dumping reach for every job, eliminating unnecessary move-up time.

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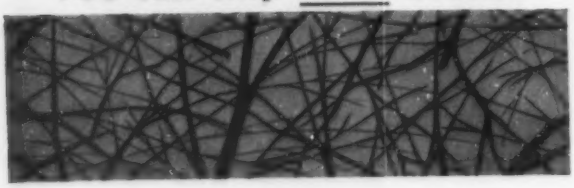

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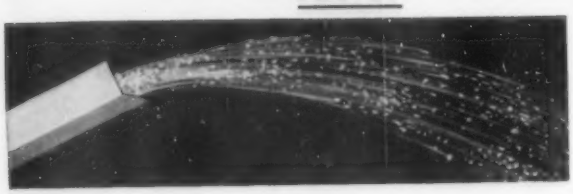
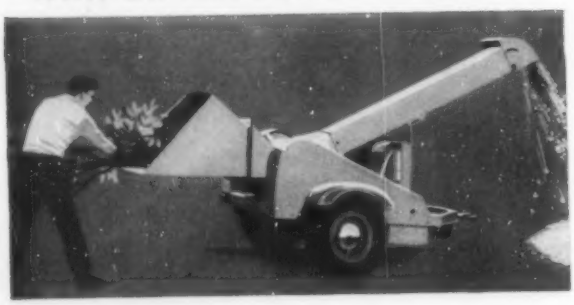


at less cost

with an ASPLUNDH CHIPPER

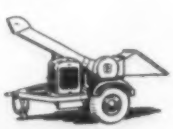


than with any other machine on the market today!

Asplundh Chippers can cut your hauling cost 75%, completely eliminate brush burning, and provide a useful, valuable by-product.

So ravenous is its appetite, so powerful its motor, and so fast its chipping action, it is equalled by no other. Yet it is so simple in design that maintenance is reduced to an absolute minimum.

Write *today* for full details. Better—ask for a prompt demonstration, without the slightest obligation.



ASPLUNDH CHIPPER COMPANY
505 York Road, Jenkintown, Pa.

By Actual Test the Fastest Chipper Made

tion unit in sewage treatment including elutriation and thickening. Recognition of overflow rate as a limiting factor has explained the disappointing results of some of the earlier installations where sufficient detention was provided by means of exceptional depths and overflow rates were consequently increased by reduction in surface area. Fortunately this condition no longer prevails.

Any discussion of sewage sedimentation inevitably brings up the subject of rectangular versus round tanks and the relative merits of each type. The theorists can and do make a clear case for the superior merits of the former mainly, it seems, because by its shape it lends itself easier to mathematical analysis. The circular tank does not have the mathematical background of the rectangular tank presumably because no one has been able to classify the various flow patterns into acceptable or convincing formulae. Therefore, with circular tanks one must rely mainly on performance to prove the soundness of design. Judging by theory alone the round tank should be inferior, but again the final test is performance.

For the Manual of Practice of Sewage Treatment Plant Design, data were obtained from 57 plants on performance of primary sedimentation units treating raw sewage. Of these 57 plants 32 had 129 individual rectangular tanks and 25 had 86 individual circular units. When the suspended solids removals were plotted against overflow rates in all of these plants the results were virtually indistinguishable as to which type was doing a superior job. There was exceptional performance in some plants of each type, but disregarding these exceptions, the one fact clearly brought out was that overflow rate was the dominating influence and not the shape of the tank. Whether the tank was rectangular or round made no significant difference. The effect of detention appears to parallel that of overflow rate but of inverse order, as the higher the overflow rate the lower the detention.

Another conclusion of this study of primary tanks is that length of effluent weir had no measurable influence on tank performance. Rates as high as 215,000 gal. per day per lin. ft. of weir were noted in tanks removing 55 percent of the suspended solids. Designs requiring specific weir rates on primary tanks are not in accordance with the evidence and can add unnecessary cost. Secondary tanks following activated sludge do seem to be affected by weir rates in some cases.

This data indicates that it is definitely misleading to assert that one shape of tank is superior to another and that some new or revised theories need to be developed which more nearly conform to the facts. However, another important point which might be raised is whether the current standard procedure for measuring tank performance is as reliable as it might be. In many ways it can be considered crude and even unscientific.

Assume, for example, that a sampler conscientiously collects a 100-ml sample of raw sewage which is about 1/25 of a gallon and in the laboratory the analyst filters out 0.02 gm. of solids. He then multiplies this weight by 10,000 and arrives at a suspended solids content of 200 mg/l. This procedure amounts to capturing 1/38 of an ounce of solids in one gallon of liquid and to assuming it is representative of millions of gallons. Proceeding in the same manner with a sample of tank effluent he finds it contains 0.008 gm. or 80 mg/l. He concludes from this data that the tank has removed 60 percent of the suspended solids or 1/66 of an ounce out of each gallon of flow. But sup-

A 9' power-sliding moldboard picks up and carries loads smoother and faster.

H-W Maintainer Offers Real Job Versatility

Whatever the job requirement . . . you can count on the versatile Huber-Warco M-52 Maintainer to turn in top performance.

The H-W Maintainer is a 45½ h.p. unit . . . weighs 6,250 lbs. . . . and features a torque converter. Working speeds range from 1.7 to 8 m.p.h., and a travel speed of 21 m.p.h. permits quick movement from job to job. The Maintainer is an all-purpose, year 'round performer, capable of outperforming many machines that are larger, heavier, more costly, slower, more expensive to operate and more limited in use.

With hydraulically cab-controlled attachments, the Huber-Warco Maintainer will perform service as a lift-loader, bulldozer, broom, snow plow, scarifier, side dozer, berm leveler and patch roller. This versatility makes it an ideal machine for all types of construction and maintenance assignments.

Your Huber-Warco distributor will be happy to give you complete details about the M-52 Maintainer . . . in fact, he will even give you a demonstration of the outstanding performance of the Maintainer. Your Huber-Warco distributor can arrange terms up to 36 months for you on the purchase of a new machine, or provide you with a rental unit. See him soon.

Huber-Warco on the job

M-52 Maintainer . . .
a top performer on all construction and maintenance jobs.

Hydraulic attachments permit the H-W Maintainer to perform service as a bulldozer, scarifier, berm leveler and lift-loader.

Huber-Warco Company

MARION, OHIO

HUBER
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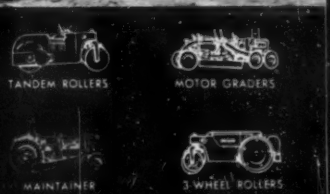

ESSICK
VIBRATING COMPACTORS

ESSICK VR-28-W PATCHING ASPHALT IN GARDEN GROVE, CALIF.

"MAINTENANCE PRODUCTION TRIPLED... ...COSTS DECREASED 80%"

SEWARD H. DART, STREET MAINTENANCE SUPERINTENDENT-SHOWN WATCHING HIS 28" ESSICK VIBRATING COMPACTOR IN ACTION—STATES:

"Irrigation water tracked into the intersections and gutter aprons in Garden Grove, constantly eroded the asphalt and made maintenance a full time problem. As a result, our gutter and intersection patching required frequent reworking, and our costs were high.

"After a demonstration of the 28" Essick Vibrating Compactor, we knew we had found the answer. It was self-propelled, hooked on the tail gate of a dump truck, and produced compaction equivalent to an 8 ton roller on asphalt. Its high frequency vibration compacts an asphalt patch that is completely dense—that can be opened immediately to traffic without any marking or damage to the asphalt.

"Now with our patching unit consisting of the 1½ ton dump truck, an Essick 120 gallon Truck Mounted Emulsion Unit, a propane torch, and the Essick VR-28-W Vibrating Compactor, the patch life has been tremendously extended, our maintenance production has tripled, and our costs have decreased 80%.

"The Essick VR-28 really solved the patch problem for us."

SELF PROPELLED — MANEUVERABLE — PORTABLE

Essick High Frequency Vibrating Compactors are constantly exceeding the densities and specifications performed by other compaction methods, while creating new standards of compaction for all types of fills, sub base, base materials, and asphalt.

CALL YOUR ESSICK DEALER FOR A DEMONSTRATION

9 Models of Vibrating Compactors from 13" to 72" Widths

Also 14 models of Tandem Rollers from ½ to 14 Tons

ESSICK MANUFACTURING COMPANY

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Affiliated with THE T. L. SMITH COMPANY, Milwaukee, Wisconsin

pose some particles were missed in the initial sampling, which is easy as the solids represent only 1/5000 part of the total, and the sampler collected what turned out to contain only 0.018 gm. on the laboratory filter, or 180 mg/l. Assuming the same effluent as before, the indicated removals would be only 50 percent. This illustrates what can happen to downgrade tank performance by sampling procedure and, of course, upgrading can occur in the same manner. More frequent sampling is one obvious remedy but this is not the entire answer.

Another example of work done by the primary tank which is often overlooked, usually disregarded and seldom mentioned, relates to digester supernatant. Assume that the primary tank is treating 1.0 mgd raw sewage with 200 ppm of suspended solids but in addition that digester supernatant in the amount of 3,000 gal. per day containing 5000 ppm suspended solids is returned to the primary influent. The influent now contains 2920 lb/day or 350 mg/l, and assuming the same effluent the tank will show a removal of 77 percent. Yet the operator's report will probably show only a 60 percent removal. Again in final tanks following activated sludge, the influent which is the mixed liquor from the aeration tanks may contain say 2000 ppm and the effluent around 20 ppm. This represents a removal of 99 percent, but no operator ever thinks of recording this figure. Perhaps the present designs are doing better than any one credits them.

The point of all this is that instead of theories concerning the path of particles, drag coefficients, inlet and outlet influences, etc., which are stimulating mental exercises, a real need exists for better evaluation of performance of full scale plant units. Models provide excellent hydraulic studies but a sewage particle never behaves the same in a model as in a plant size unit. Possibly more attention should be paid to the weight of solids removed via the sludge outlet. This presents difficulties but they are not nearly so great as trying to determine the solids fraction of the raw sewage. In the sludge the solids concentration is usually 200 to 250 times greater than in the raw sewage and the chances for error are correspondingly reduced. Why not begin with the solids in the tank effluent, add the solids removed as sludge, and the sum becomes the solids in the influent? This will give a true index of tank performance. Anyone who has tried to balance sludge solids with suspended solids removals usually finds some startling discrepancies.

Of course, the important answer to efficient performance is the amount of solids in the final effluent and if that satisfies authorities, maybe testing is unnecessary as long as it is recognized that other factors than tank shape have far more influence on the results.

• • •

Equipment Available for Minnesota Highway Department

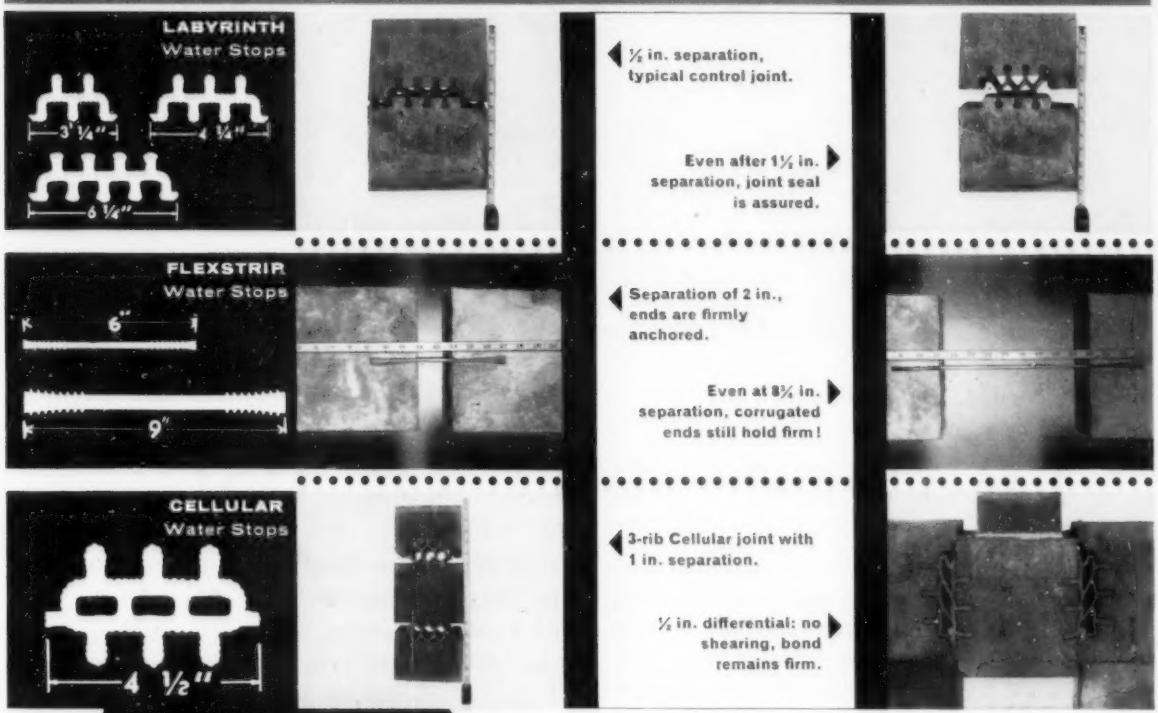
During the past biennium the Minnesota Highway Department plant and equipment section, new equipment purchases totaled $1.79 million. On hand at the close of the biennium were three airplanes, 283 patrol cars, 276 passenger cars, 1,253 trucks, 135 motor graders, 282 tractors, 194 graders. 1,473 snow plows and wings, 447 sand spreaders, 800 mowers, 55 mixers, 194 tar kettles and 1,239 miscellaneous pieces of equipment.

Look at PROOF of Water Seals' performance!

Here's why they are the Waterstop your jobs deserve

Grueling laboratory tests merely bear out what years of experience on countless jobs have proved: to *stop water* seepage between successive concrete pours, there's no water stop to match Water Seals. Made of the finest polyvinyl chloride resin, Water Seals are unaffected by acids, alkalies, organic chemicals: their bond is sure and water tight even at 150°F and against heads of 200 feet. And they're installed at a fraction of the cost of other types—and much faster. Cut and spliced in the field with a hot knife. Every good water-proof concrete job design should include Water Seals water stops. These pictures show why . . .

THEY SEAL . . . THEY STRETCH . . . THEY SHIFT



SEND FOR A SAMPLE SECTION!
Use coupon for sample of type of Water Seals water stop that interests you—and descriptive literature. No charge, of course.

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Send samples of _____ type of Water Seals water stop and descriptive literature.

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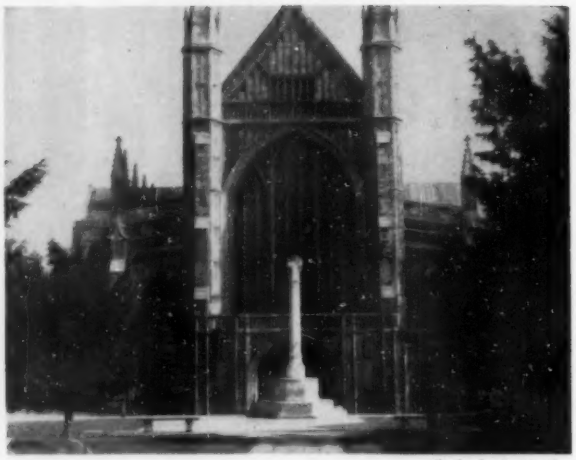
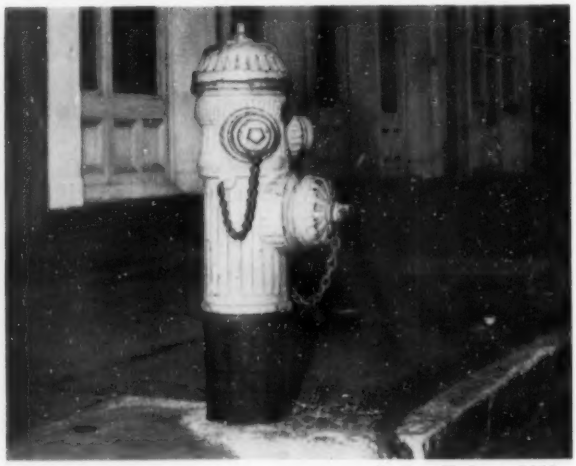
Aqueduct, 105 B. C.



Cathedral, 1065

Fountain, 1650



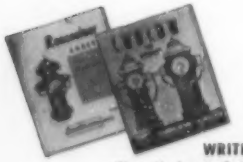
Ludlow Hydrant, 1883

SO WELL-MADE

they're still in use!

In a sense, Ludlow and Rensselaer fire hydrants are among the great man-made objects. They're built to *last*. All Ludlow and Rensselaer hydrants are made to stay on the job through years of rough treatment and rigorous climate —never quitting!

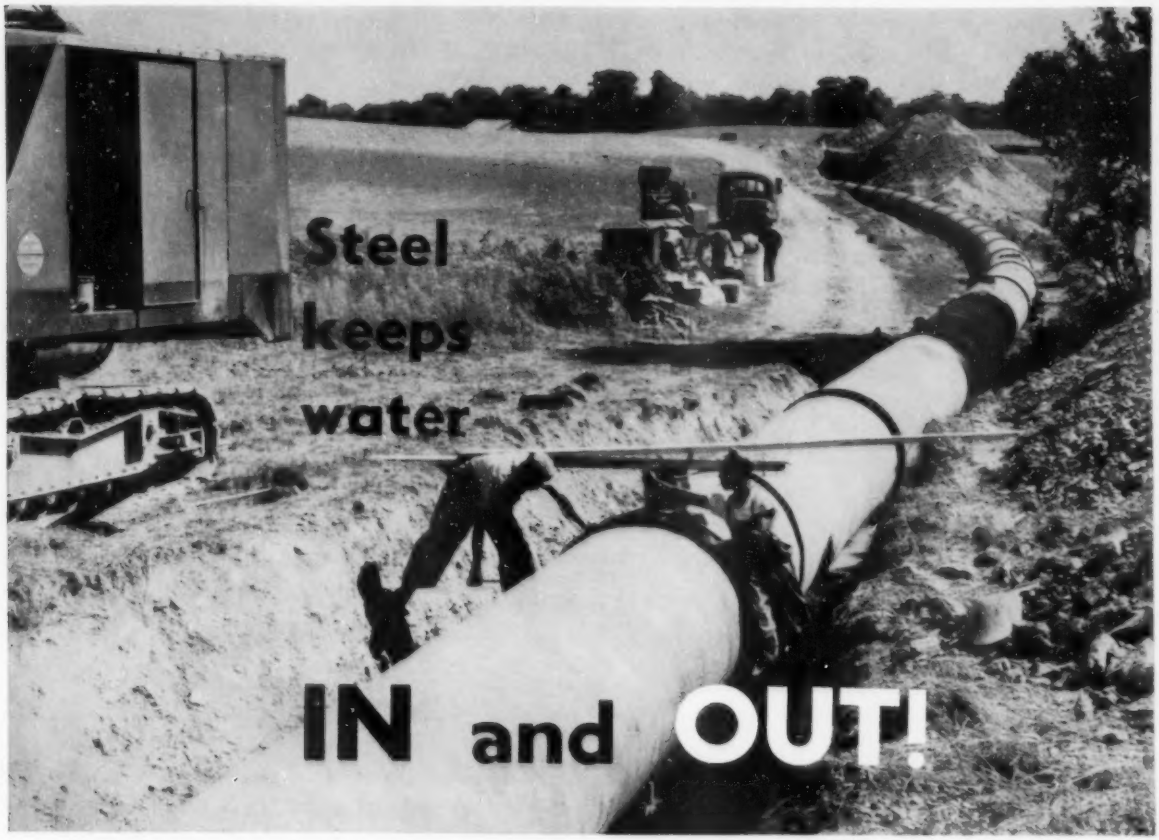
Developed through nearly 100 years of practical experience, Ludlow and Rensselaer hydrants have *earned* their title of "watchdogs of American property." Without exception, they give you the 4 basic requirements for hydrant performance: simplicity of design, absolutely tight closure, no freezing and no flooding due to standpipe breakage.



WRITE TODAY for L&R Fire Hydrant Catalogs showing a model for every need.

LUDLOW & RENSSELAER
VALVES AND HYDRANTS

THE LUDLOW VALVE MANUFACTURING CO., INC., TROY, N.Y.—SINCE 1861



Whether it's running through soft ground, or taking a pounding under city streets, steel pipe delivers *all* the water all the time. No "unaccounted-for-water" losses . . . and just as important, no contamination by ground water infiltration into the line.

No other material provides such ease of installation. Fabricated to order in extra long lengths, steel pipe is easy to haul, easy to handle, and easy to join.

Leak-proof, flexible couplings enable the pipe to follow the contours of the terrain . . . take long curves, rise and drop with natural slopes, and remain tight despite washouts, cave-ins.

Installation costs of steel pipe water lines are low because of the fewer pipe lengths required, and because of the ease and speed of installation. Particularly in the tough spots . . . hanging suspended over chasms, tunneling through mud, clay or quicksand, taking the pressures generated as the line runs down a mountain . . . it's always best to pipe water with steel . . . it's often the only way.

Steel fabricated pipe saves money. Specify steel with confidence!

STEEL PLATE FABRICATORS ASSOCIATION

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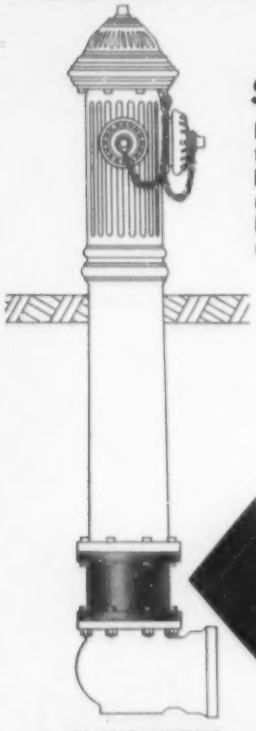
Grade changes caused this.

HERE IS HOW SMITH HYDRANTS CAN BE EXTENDED

If existing Fire Hydrant Nozzles and Caps are not readily accessible due to grade changes this condition can be quickly and economically corrected by installing Hydrant Standpipe Extensions as illustrated. The installation of the Extension will provide clearance between the groundline and the Hydrant Nozzles permitting the free rotation of the wrench and the quick coupling of fire hose to existing Hydrants.



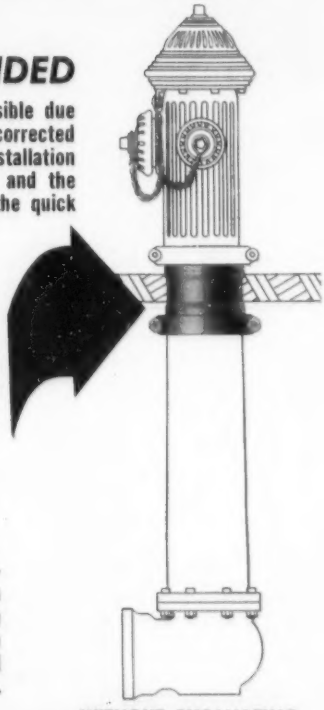
BY EXCAVATING

PROTECTOP HYDRANT

Depth of bury can be increased by installing Standpipe and Main Valve Rod Extensions at the groundline between the Upper and Lower Sections. This construction permits installation of the Extension without excavating and the reuse of the original Hydrant internal operating parts. The Extensions are produced in 6″ increments.

ONE PIECE STANDPIPE OR TWO PART HYDRANT

After the Standpipe is excavated the extension is installed between the bottom of the Standpipe and the Hydrant Elbow. The depth of bury is increased by the desired amount reusing the original operating parts. The Extension thread accepts the original Main Valve Rod assembly. The Extensions are produced in 6″ increments.



WITHOUT EXCAVATING

FIRE HYDRANTS · VALVES · SINCE 1896

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

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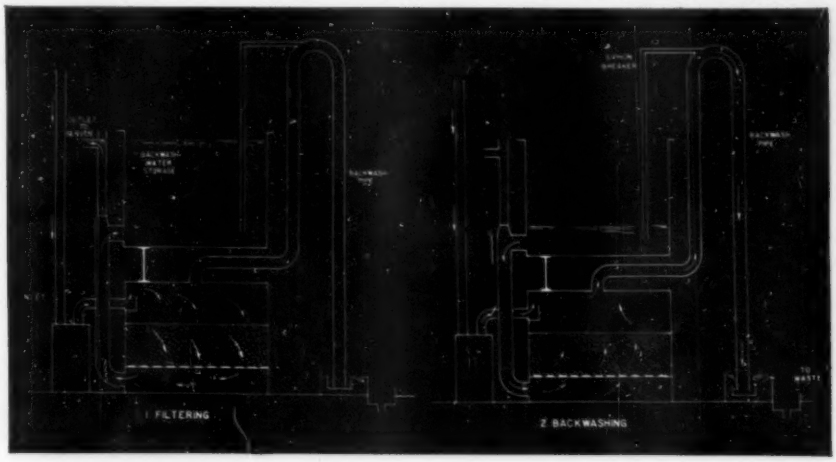
is a Pfaudler Permutit program providing
the know-how
the equipment
and the experience
for solving problems involving fluids

Permutit valveless filter, municipal design



FLUIDICS covers such varied phases of fluid handling and control as:

corrosioneering
water treatment
waste treatment
fluid analysis
agitation
blending
metering
valving
flow rate control
piping
storing
heat transfer
pumping

Whenever you have a fluid-handling problem, put the Pfaudler Permutit FLUIDICS program to work.

PFAUDLER PERMUTIT INC.

Specialists in FLUIDICS . . . the science of fluid processes

FLUIDICS AT WORK

The only filter that works by itself

We sell most of our Permutit valveless filters simply by pointing out the things you *don't* have to do and the things you *don't* need once you install one:

Manpower—None needed. No valves to operate, gauges to watch, pumps to start or stop, or decisions to be made.

Valves—None. Entire operation is automatic and hydraulic.

Pumps—None needed. All work done by atmospheric pressure.

Rotary wash—None needed. Unit operates only to four- or five-foot head . . . schmutzdecke cannot become packed enough to need breaking up.

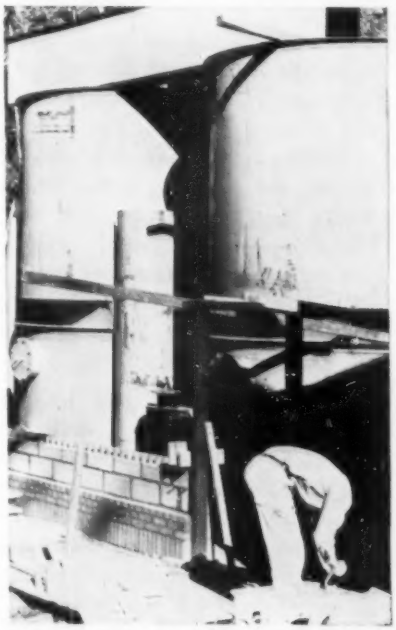
Flow controller—No mechanical, pneumatic, or hydraulic devices needed . . . unit filters whatever volume you deliver.

Maintenance — None, outside of normal, routine painting. No moving parts to wear out.

The best part of our story is the fact that this filter costs less than conventional gravity filters, either manual or automatic.

The basic laws of hydraulics behind this filter's design show in the diagrams. If you're rusty on your hydraulics, or are just plain interested, we invite you to write for our bulletin on valveless filters.

Address yourself to our Permutit Division, Department PW-79, 50 West 44th Street, New York 36, New York.



Automatic valveless gravity filters, like this tandem setup photographed during its installation at an Eastern municipality, are now in service.

City of Hampton, Virginia, has a population of 80,000 and covers an area of 90 square miles.
This No. 112, one of three machines used to maintain 350 miles of road, delivers outstanding performance.

This No. 112 does a big job at low operating cost for the City of Hampton

You're looking at a Cat No. 112 Motor Grader working shoulders on a typical street in the City of Hampton, Virginia. The No. 112 averages 5 miles per 7-hour day on this job. The city keeps it busy all year round rebuilding roads, spreading rock and lime, cleaning ditches and removing snow. Officials in the Public Works Department responsible for its purchase say this about its performance: "The No. 112 does a big job for us at low operating cost. Our maintenance worries are nonexistent. We are very satisfied with it and with the speed and reliability of service from our Caterpillar Dealer."

When you invest your taxpayers' dollars in a machine, performance and dealer service are two important factors to consider. Even more important is this factor—*total* cost. Public records from all over the country prove that the *low* total cost of Cat Motor Graders makes them your best investment. Accurate cost records of yearly operation and maintenance give evidence of the job you can expect from a Cat-built machine.

To match your job needs, your Caterpillar Dealer offers two other Motor Graders besides the 75 HP, 20,805 lb. No. 112. There's the 115 HP, 23,115 lb. No. 12 and the new 150 HP, 29,280 lb. No. 14. Each is designed to do more work at lower cost with less down time than any other grader in its class. Ask to see them work!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

PRECO AUTOMATIC BLADE CONTROL CUTS GRADING TIME IN HALF

—optional on the Cat No. 112 Motor Grader

Exclusive with Caterpillar, the Preco Control is now transistorized for freedom of maintenance and adjustment. The operator sets the desired slope on a dial, and the unit automatically maintains blade slope within ⅛" in 10', regardless of position of grader or unevenness of terrain. Fine for *all* types of grading. Preco is also optional on the No. 12 and No. 14.

Mechanical controls (standard) offer positive action, make blade adjustment precise. Powered right from the engine, they give a speed and range of blade movements that no other unit can match.

CATERPILLAR

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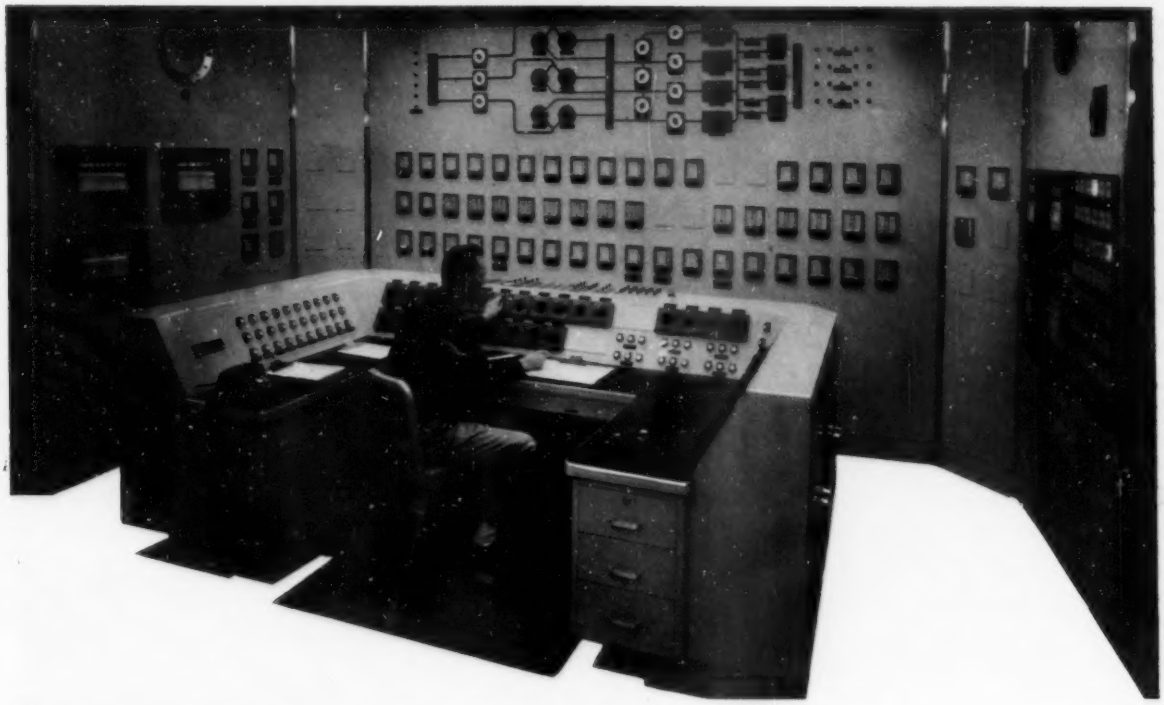
BUY LOW TOTAL COST—
BUY CAT MOTOR GRADERS

Volume 90, Number 7

PUBLIC WORKS Magazine

July, 1959



INSTRUMENTATION

for Process Control in a Modern Water Treatment Plant

ANDREW A. ZAHNER,

Burns & McDonnell Engineering Company
Kansas City, Missouri

IN 1952 a report was written and in 1953 design was started on a $12 million expansion and modernization program for the Kansas City, Missouri, water treatment plant. The original plant capacity of 100 mgd was to be increased to 210 mgd to meet immediate and future requirements. Because of the area covered by the expanded plant, approximately 100 acres, it was decided that the old method of process analysis (having an attendant tour the plant, obtain grab samples, return to the laboratory, run analyses, adjust the treatment and then repeat this procedure) would consume too much time. Therefore, after careful study it appeared to be economically and functionally desirable to centralize process analysis and control for the entire plant at two critical locations.

All pumping operations are controlled from a room located in the secondary pump station. Operations from this location include selection, starting, stopping and regulating speed of the intake pumps, valves, and screens which are located at the river, approximately ¼ mile from this station; selecting, starting, stopping and throttling of the ten secondary pumps which supply the pumping stations south of the Missouri River; selecting, starting, stopping and throttling the Kansas City North very high head pumps which supply all the Kansas City area north of the Missouri River; and selecting, starting, and stopping the house service pumps. Also from this location, pumpage, elevated tank level, clearwell level and flow to the clearwell are indicated and recorded, and a booster pump station approximately 5 miles away is controlled.

All primary process analyses and control operations are performed from a control room located in the Chemical Building. Process analyses which are indicated and recorded at this location are: Total raw water flow; raw water turbidity and temperature; raw water flow to

each pair of presedimentation basins; settled water flow to each secondary basin; total settled water flow; settled water turbidity; quantity of chemical sludge return to each presedimentation basin; and total chemical sludge flow.

Also, instrumentation is provided for chemical feed rates for lime, soda ash, ferric sulfate, activated carbon, chlorine, and ammonia; lime slaker temperature; pH of the softened water; amount of oil and/or natural gas being used for primary recarbonation; percent oxygen for each carbon dioxide generator; pH of the recarbonated water; amount of oil and/or natural gas being used for final recarbonation; percent oxygen for each carbon dioxide generator; pH of the stabilized water; ambient air temperature and relative humidity; and turbidity of the filter influent water.

All recorders on the Chemical Building panelboard have 30-day charts with pens holding a 30-day supply of ink. Since there are seventy recorders on this panelboard, changing charts and inking of pens daily would consume a considerable amount of time. For this installation, instead of performing this operation 365 times a year, it is performed only twelve times a year.

A chlorine residual recorder is located in the filter operator's control room in the filter building.

The main components for the water purification, softening and stabilization process, such as chemical feed rates, flow, etc., are controlled from a console located in front of the Chemical Building instrument panelboard. This allows one operator to observe the flow rates and process, and make the required adjustments from one location.

pH Measuring Cells

Of the instrumentation and control in this plant, the use of pH measuring cells and flow colorimeters as turbidity analyzers is unique for water treatment plants. Kansas City water is softened with soda ash and lime. Since a relationship exists between treatment process (such as magnesium removal, recarbonation, and stability) and pH, the softening process can be checked through the plant if the pH of the water is known.

A total of 15 pH electrode assemblies and 9 amplifiers is utilized at this plant with the following distribution: Six electrode assemblies, two automatic selector switches and three amplifiers for softened water pH; and six electrode assemblies, one automatic selector switch, and three amplifiers for stabilized water pH. The reason for the difference in the number of electrode assemblies and amplifiers is that sampling points in some cases were close enough together to connect the electrode assemblies to one amplifier through an automatic selector switch, which is wired as a slave to the strip chart recorder selector switch located on the panelboard. The use of selector switches to eliminate amplifiers is done for economic reasons. The desired end result is obtained with a lower first cost. Because of the low voltage across the electrodes, the distance between electrodes and amplifiers must be limited to approximately 200 feet. Each electrode assembly includes a temperature compensating electrode which is a necessity because of the annual temperature variation of surface water such as the Missouri River. The time interval between points on the selector switches is critical to the extent that an electrode assembly takes about 45 seconds to stabilize because of the thermal compensating electrode. All pH values for each plant position, that is, softened water, recarbonated water and stabilized water are indicated and recorded on multi-point strip chart recorders. High and low alarm contacts are provided on each recorder to give the operator an audible and visual alarm if the pH value goes beyond predetermined limits of the set point.

Printing speed for the pH strip chart recorders is sixty seconds. As the selector switches move from one point to another, all electrode assemblies are out of the energized circuit with the exception of the one unit which is to be recorded. The components hold this closed circuit for one minute for the temperature compensating and reference electrode to stabilize, which occurs in approximately 45 to 50 seconds, and then the recorder prints the pH value of the selected point at the end of this 60-second cycle. The unit components then move to the next point and this cycle is repeated again.

Experience in this and other water plants has proven that the use of immersion assemblies is much more desirable than flow assemblies. Because of the plating action of lime and calcium carbonate, electrodes need cleaning at intervals from once a week to once every two months depending on their location. The deposition of these chemicals in lines to flow assemblies and in the flow assembly constitutes additional maintenance problems as compared to the immersion assemblies.

● **FILTER influent turbidity analyzer and amplifier. The author is depressing "check" button which turns out the light and indicates zero transmittance to viewer.**

At this plant, the electrode assemblies used for recarbonated water are of the immersion type and have been installed on floats to adjust to the different water levels encountered by various plant flow rates. A pan with small perforations in the bottom is located beneath the electrodes to allow water to flow by the electrodes and eliminate any

gas bubbles from coming in contact with the electrodes. If these bubbles, which are from the carbon dioxide diffusers, come in contact with electrodes, an error is introduced into the pH measuring system.

Flow Colorimeters

A function of this water plant other than softening is clarification. Clarification includes settling of solids, precipitation and settling of solids, and filtration. Flow colorimeters were installed to monitor, indicate, and record continually the turbidity of the water at critical points in the plant. These points are the raw water (Missouri River water), settled water (presedimentation basin effluent) and filter influent water.

Turbidity of water is usually caused by the presence of suspended matter, such as clay, silt, finely divided organic matter, plankton and other microscopic organisms. Turbidity should be clearly understood to be an expression of the optical property of a sample which causes light rays to be scattered and absorbed, rather than transmitted in straight lines through the sample. Attempts to correlate turbidity with the weight concentrations of suspended matter are impractical as the size, shape, and refractive index of the particular materials are of importance optically and bear little direct relationship to the concentration and specific gravity of the suspended matter.

In order to make a recorder read directly in ppm, it is necessary to adopt a turbidity standard and use this standard with all instruments in any one plant. The recorders can then be calibrated in terms of this particular standard.

The primary fundamental components of a flow colorimeter or turbidity analyzer are: transformer, constant voltage lamp, lens to provide a straight line path and eliminate loss of energy by diffusion of light, filter to compensate light quality so that meaningless color will not introduce errors and a photo tube to sense the percent of light transmitted.

Ranges selected for these turbidity analyzers were: raw water, 0-2000 ppm; settled water, 0-1000 ppm; and filter influent water, 0-50 ppm.

After light path lengths were determined, the units were calibrated and the curve was plotted showing percent transmittance versus turbidity. From these curves, it was noted that the analyzers did not read zero transmittance until at 4000 ppm for the raw water, 2000 ppm for the settled water and 60 ppm for the filter influent water. Actual ranges used for the recorders were those determined by the calibration curves. Since the best readability is at the lower end of the curve, the additional range added occurs in the region of minimum readability.

A standard solution, using Fuller's earth, was used to determine turbidity. With this solution, the instrument is calibrated, using known concentrations of a nearly reproducible turbidity standard. This permits the turbidity to be measured and expressed in terms of the standard solution selected, without regard to the material actually causing the turbidity in the sample being analyzed. As a general standard in water works, this comparison of turbidity of a sample, to that of a reference is now done visually.

It is necessary to calibrate the turbidity analyzers only once and plot a curve showing turbidity in ppm versus percent transmittance. In normal plant operation, the instruments are periodically checked with finished water, which for all practical purposes contains no turbidity, and by turning the light source off. This enables the instrument components to be calibrated at 100 percent and zero percent transmittance. It is not necessary to use the standard solutions and duplicate the curve already plotted.

It is necessary to check several samples of raw water to select the proper filter to make certain that the color variation of the water will have no effect on the instrument. These samples should be representative of the color variations encountered in the water to be sampled.

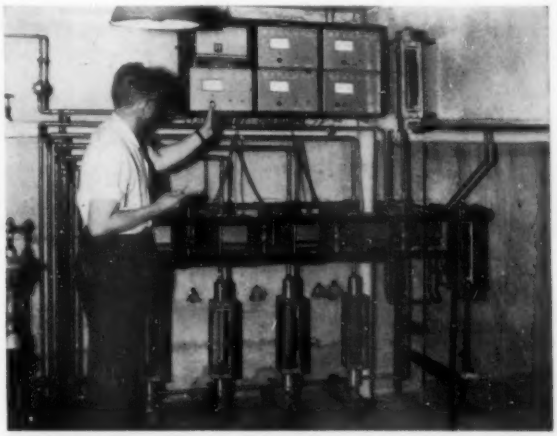
Light path lengths are determined from the turbidity range of the sample to be analyzed. Samples of high turbidity will have relatively short paths and conversely, samples of low turbidities will have longer light paths.

Missouri River water has turbidities in excess of 10,000 ppm, but since some of the reservoirs have been completed on the upper river, the time of river turbidity peaks has been reduced. A study of the recent annual river turbidity data indicates that the range of 0 to 2,000 ppm will be adequate 79 percent of the year. This should improve since the construction program for the dams on the Missouri River has not been completed.

To enable the flow colorimeter to function during periods of turbidity higher than 2,000 ppm, a system was

(*Continued on page* 176)

● **RECORDERS and annunciator for pH and percent oxygen. Operator is noting water pH at various points in the plant.**



● **TURBIDITY analyzers, amplifiers and piping for raw and settled water. The unit at far right is for raw water.**

THE USES OF ASPHALTIC MATERIALS IN HIGHWAY PAVEMENTS

LADIS H. CSANYI, Professor in Charge, Bituminous Research Laboratory, Iowa State College, Ames, Iowa

TABLE I—RAPID-CURING LIQUID ASPHALTIC MATERIALS

Specification Designation		RC-0	RC-1	RC-2	RC-3	RC-4	RC-5
General Requirements	ASTM Method	The material shall be free from water					
Flash Point (Open Tag.), °F	*	...	...	80+	80+	80+	80+
Furol Viscosity at 77°F. sec.	D88	75-150	...	...	...	...	...
Furol Viscosity at 122°F. sec.		...	75-150	...	...	...	...
Furol Viscosity at 140°F. sec.		...	...	100-200	250-500	...	...
Furol Viscosity at 180°F. sec.		...	...	...	...	125-250	300-600
Distillation							
Distillate (percent of total distillate to 680°F.)							
To 374°F.	D402	15+	10+	...	...	...	...
To 437°F.		55+	50+	40+	25+	8+	...
To 500°F.		75+	70+	65+	55+	40+	25+
To 600°F.		90+	88+	87+	83+	80+	70+
Residue from distillation to 680°F. Volume percent by difference.		50+	60+	67+	73+	78+	82+
Tests on Residue from Distillation							
Penetration 77°F., 100 g., 5 sec.	D5	80-120	80-120	80-120	80-120	80-120	80-120
Ductility 77°F.	D113	100+	100+	100+	100+	100+	100+
Solubility in Carbon Tetrachloride, %.	D4**	99.5+	99.5+	99.5+	99.5+	99.5+	99.5+
Temperature of Use							
For spraying, °F.	...	50-120	80-150	100-175	150-200	175-250	200-275
For mixing, °F.	...	50-120	80-125	80-150	125-175	150-200	175-225

* AASHO Method T79.
** Except that carbon tetrachloride is used instead of carbon disulphide as solvent, Method No. 1.

ASPHALTS used for paving purposes in the United States are principally derived from the distillation of asphalt base petroleums. Upon removal of gasoline, kerosene and other volatiles from the crude petroleum an asphaltic residual oil remains in the still. This residual oil contains asphalt and heavy oils. Petroleums may also be refined under high temperature and pressure in a process known as cracking. In this process the molecular composition of the residual asphalt is modified in a way which is believed to make such an asphalt unsuitable for paving purposes.

The asphaltic residual oil secured from the distillation process must be refined further by distillation to remove some of the heavy oils so that a uniform and consistent material known as asphalt cement is produced. Asphalt cement is the basic material of the asphalt industry. This material may be processed by the addition of volatile solvents such as gasoline, naphtha, kerosene or light oils to form cut-back asphalts. It may also be processed with water and emulsifying agents to form emulsified asphalts. Thus, there are available for paving purposes the following general categories of asphalts: Asphaltic residual oils, asphalt cements, cut-back asphalts and emulsified asphalts.

Residual Asphaltic Oils

Residual asphaltic oils, being the dregs of the distillation of petroleum, seldom are consistent in composition. Since the residual oils vary widely in asphalt and oil content they are not used in asphalt pavements and surfaces. They are, however, used extensively for dust control where cost is more important than uniform composition. Residual oils, or road oils as they are frequently called, are quite

liquid at 77°F and therefore can readily soak into the surfaces of dirt or gravel roads. They also contain sufficient asphalt to bond the surface and enough oil to keep the material plastic for an extended period of time. Thus they are quite effective as low cost dust palliatives and light surface treatments.

Asphalt Cements

Asphalt cement commonly called AC or paving asphalt is produced by refining asphalt residual oils. In this refining process heavy oils are removed from the residual, usually by steam distillation until a desired ratio of oil to asphalt is secured. Asphalt cements of various consistencies or hardnesses ranging from soft to hard can thus be prepared. This consistency of the asphalt cement is measured at 77°F by the penetration test. Various grades of AC, based on the penetration test, have been standardized as follows: Hard asphalts that may be powdered usually have a penetration less than 10. Intermediate grades have penetrations of 60-70, 85-100, 120-150. Soft asphalts have penetrations of 200-300 and 300 plus.

Asphalt cement is an organic material composed of constituent compounds containing carbon and hydrogen and small quantities of oxygen, sulphur and other elements. The principal constituent compounds are generally known as asphaltenes, resins and petrolenes. The asphaltenes give the asphalt its body and its black color. The resins hold the material together and give it ductility. The petrolenes, or oily constituents effect its consistency. Thus the quantity of each of these constituents present in an asphalt cement will have a bearing upon its physical properties. Large quantities of asphaltenes make it harder and more brittle, while more resins make it more ductile and increase in petrolenes make it softer.

Asphalt cement is said to be a rheological material whose physical properties are altered by temperature. When an AC is cold, it is hard and brittle. At about 77°F, it is a plastic semi-solid. As the temperature is raised it becomes a viscous liquid at about 225°F and a liquid at 325°F regardless of its original penetration. If the temperature is raised over 350°F and held there for a period of time, its composition changes and it hardens. If heated over 500°F, it will begin to coke and solidify. If, however, the temperature is not raised over 325°F and it is then allowed to cool, it will pass through the various physical states in the reverse order and return to its original condition.

The consistency or viscosity of an AC may be modified either permanently or temporarily in several ways other than temperature change. The hardness of an AC may be permanently increased by the addition of a harder asphalt or the removal of some of its oily constituents, in proper quantities to provide the desired hardness. It may

TABLE II—MEDIUM-CURING LIQUID ASPHALTIC MATERIALS

Specification Designation		MC-0	MC-1	MC-2	MC-3	MC-4	MC-5
General Requirements	ASTM Method	The material shall be free from water					
Flash Point (Open Tag.), °F.	*	100+	100+	150+	150+	150+	150+
Furol Viscosity at 77°F., sec.	D88	75-150	...	...	...	...	...
Furol Viscosity at 122°F., sec.		...	75-150	...	...	...	...
Furol Viscosity at 140°F., sec.		...	...	100-200	250-500	...	...
Furol Viscosity at 180°F., sec.		...	...	...	...	125-250	300-600
Distillation							
Distillate (percent of total distillate to 680°F.)							
To 437°F.	D402	25-	20-	10-	5-	0	0
To 500°F.		40-70	25-65	15-55	5-40	30-	20-
To 600°F.		75-93	70-90	60-87	55-85	40-80	20-75
Residue from distillation to 680°F. Volume percent, by difference		50+	60+	67+	73+	78+	82+
Tests on Residue from Distillation							
Penetration 77°F., 100 g., 5 sec.	D5	120-300	120-300	120-300	120-300	120-300	120-300
Ductility 77°F.**	D113	100+	100+	100+	100+	100+	100+
Solubility in Carbon Tetrachloride, %.	D4***	99.5+	99.5+	99.5+	99.5+	99.5+	99.5+
Temperature of Use							
For spraying, °F.	...	50-120	80-150	100-200	175-250	200-275	225-275
For mixing, °F.	...	50-120	80-150	100-200	150-200	175-225	200-250

* AASHO Method T79.
** If penetration of residue is more than 200 and its ductility at 77°F. is less than 100, the material will be acceptable if its ductility at 60°F. is 100+.
*** Except that carbon tetrachloride is used instead of carbon disulphide as solvent, Method No. 1

also be hardened by processing with oxygen, as in the production of blown asphalts. Asphalts also harden naturally by aging in service, through the evaporation of the oily constituent, the oxidation from the air and the ultraviolet and infrared rays of the sun which apparently alter the composition of the asphalt.

Asphalt cements may be permanently softened by the addition of proper quantities of softer asphalt or a flux oil needed to attain the desired softness.

and for a short period of time as in mixing without changing the composition of the asphalt. During mixing, as the foamed asphalt comes in contact with aggregates, the foam breaks and the asphalt regains its original properties.

An asphalt cement may be temporarily liquefied at 77°F by several means. One way is by dissolving the AC in a solvent such as naphtha, gasoline, kerosene or a light oil. The degree of liquefication depends largely upon the quantity of solvent

tributed throughout the asphalt. The degree of liquefication depends upon the amount of water and the size of the dispersed droplets to a large degree, while the duration of the liquid character depends upon the type of emulsifying agent used. When the emulsified asphalt breaks, the droplets of AC join together into one mass and the AC regains its original properties. At the same time the water either drains away or evaporates.

Since an asphalt must be capable

TABLE III—SLOW CURING LIQUID ASPHALTIC MATERIALS

Specification Designation		SC-0	SC-1	SC-2	SC-3	SC-4	SC-5
General Requirements	**ASTM Method**	**The material shall be free from water**					
Flash Point (Cleveland Open Cup), °F.	D92	150+	150+	175+	200+	225+	250+
Furol Viscosity at 77°F. sec.	D88	75-150	...	...	...	...	...
Furol Viscosity at 122°F. sec.		...	75-150	...	...	...	...
Furol Viscosity at 140°F. sec.		...	...	100-200	250-500	...	...
Furol Viscosity at 180°F. sec.		...	...	...	...	125-250	300-600
Water, percent	D95	0.5-	0.5-				
Distillation							
Total Distillate to 680°F.	D402	15-40	10-30	5-25	2-15	10-	5-
Float Test on Residue at 122°F., sec.	D139	15-100	20-100	25-100	50-125	60-150	75-200
Asphalt Residue of 100 Penetration, %.	D243	40+	50+	60+	70+	75+	80+
Ductility Asphalt Residue at 77°F.	D113	100+	100+	100+	100+	100+	100+
Solubility in Carbon Tetrachloride, %.	D4*	99.5+	99.5+	99.5+	99.5+	99.5+	99.5+
Temperature of Use							
For spraying, °F.	...	50-120	80-200	150-200	175-250	175-250	200-275
For mixing, °F.	...	50-120	80-200	150-200	175-250	175-250	200-275

*** Except that carbon tetrachloride is used instead of carbon disulphide as solvent, method No. 1. If the material fails to meet the requirement for solubility it will be acceptable if its solubility in carbon disulphide is 99%+, and proportion of bitumen soluble in carbon tetrachloride is 99.65%+.**

The degree of penetration and some other physical properties such as surface tension and specific gravity of an asphalt, may be temporarily modified by foaming the asphalt. When water or steam is introduced into an asphalt at 225°F or over, the asphalt will foam rapidly. In foaming, the volume of the asphalt increases greatly and it becomes very liquid. Uncontrolled foaming of an asphalt should be avoided. If that should occur, the foaming may be eliminated by the addition of small quantities of a silicone antifoaming agent. When the foam is created under control as in the "Foamed Asphalt Process", the viscosity of a 60-70 penetration asphalt may be altered to that of 300 plus penetration AC temporarily

used while the duration of time the liquid is retained depends not only upon the quantity but also the type of solvent used. As the solvent evaporates, the AC gradually regains its original properties. The group of asphalts treated in this manner are known as Cut-Back Asphalts.

Another way in which an AC may be liquefied temporarily is by mixing it with water in a colloid mill in the presence of an emulsifying agent. The group of asphalts treated in this manner are known as emulsified asphalts. Two types of emulsified asphalts are produced. The more common one is a direct emulsion in which the asphalt as tiny droplets is dispersed in water. In the other type an indirect or inverted emulsion, the water is dis-

of sticking firmly and tenaciously to particles of an aggregate and must also possess sufficient internal strength to hold these particles together under traffic its adhesive and cohesive properties are of considerable importance.

Adhesion between an asphalt and an aggregate depends on many factors and properties of both the asphalt and the aggregate. One of the factors of considerable importance is the affinity between the asphalt and the aggregate. Hydrophobic aggregates, that repel water or permit asphalt to displace water on their surfaces, have a high affinity for asphalt. Hydrophillic aggregates, that attract water, will prevent asphalt from adhering to their sur-

(*Continued on page* 192)

THE COUNTY ENGINEER and the CONSULTANT

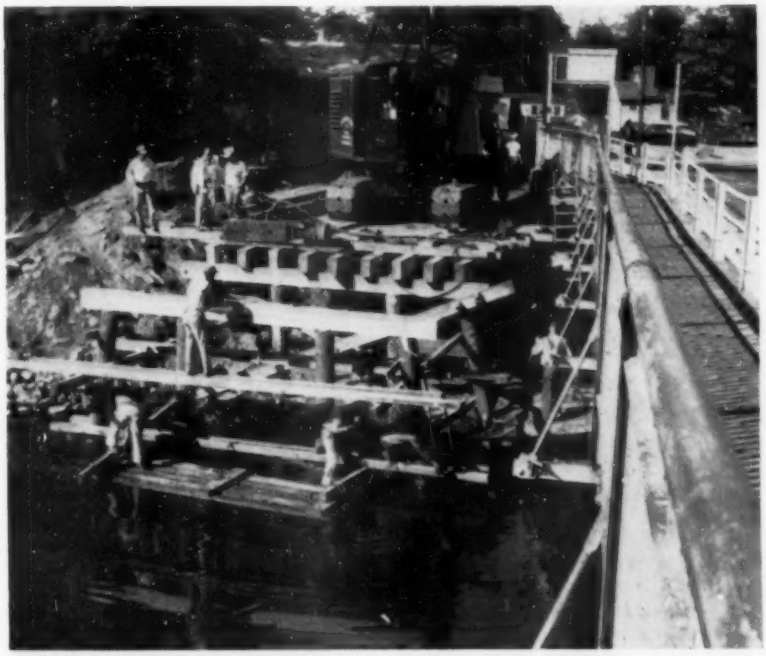
WALTER L. BRAYBROOKE,
Chief Highway Engineer,
and
ABBA G. LICHTENSTEIN,
Principal Structural Engineer,
Goodkind & O'Dea,
Consulting Engineers,
Bloomfield, New Jersey

WITH THE growing importance of local roads and streets maintained by counties, the job of the county engineer has become more difficult and time-consuming. Though capable and dedicated to his job, he usually has a limited staff which is best equipped to deal with the everyday engineering demands of the county.

When the county engineer is faced with the replacement of an old bridge involving foundation or hydraulic problems or with the construction of a new highway to accommodate large volumes of traffic, he often finds that his staff is undermanned and overworked. It is in such situations that a consulting engineer can be of major value. Some of the ways in which the consultant can provide this help are:

1) By doing the once-in-a-while job, for example a bridge replacement or a highway relocation.
2) By providing the services of specialists which the County Engineer cannot be expected to have on his own staff: Soils Engineer, Traffic Engineer, etc.
3) By stepping in when an emergency occurs, increasing greatly the work load. For instance, should a damaging flood or similar disaster occur the Consulting Engineer can assess the damages, plan the repairs and supervise the rehabilitation.
4) By providing an engineering report, either short or long-range. For example: a sufficiency rating of the county highway system with recommendations for future overall planning including a program of repairs, rehabilitation and replacement.
5) By providing the personnel to speed up preparation of plans when deadlines become important.

The following is a typical example of a bridge replacement job. It involves the matters of Federal and State approvals and the meeting of a deadline.

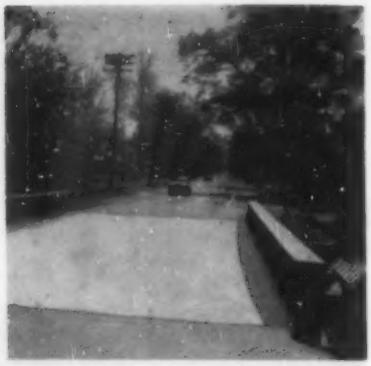


● **CONSTRUCTING Aqueduct Bridge: Soil borings were made and waterway opening determined. H-pile foundations were used; bridge was designed for H20 S16 loading.**

The emergency provisions of the Federal Aid Highway Act of 1958 permitted the inclusion of certain county projects. The county engineers of Somerset and Middlesex Counties, New Jersey, D. H. Stires and H. R. Fleming, had a common problem in a bridge over the Green Brook at Washington Avenue, Dunellen. Here was an opportunity to finance a replacement without infringing on the regular aid allotment or other county funds. The existing structure was too narrow for the heavy truck traffic using it. In addition the waterway opening was inadequate and had been responsible for severe flooding.

Bridge Replacement

The New Jersey State Highway Department, which was delegated by the Bureau of Public Roads to approve projects under the emergency provisions, agreed to include the replacement of this bridge under the Federal Act if the completed construction plans and specifications were submitted to the State by July 1, 1958. Mr. Stires, authorized to represent both counties for this project, requested Goodkind & O'Dea to submit a proposal for consulting services. This proposal was prepared and promptly accepted on May 23, 1958. The consulting engineer then proceeded to make a survey of the site including cross-sections of the Green Brook for a certain distance on each side of the bridge. Borings were taken under the supervision of the consultant to determine the foundation conditions for the new structure. The State Division of Water Policy and Supply, which has jurisdiction over streams and channels, was consulted as to the required waterway opening. All utility companies involved in the crossing were notified and the relocation of their facilities were discussed with them.



● **OLD BRIDGE over Green Brook on Washington Ave., was very narrow.**

Upon assemblage of all this information, a preliminary design sheet was prepared showing the details of the new structure. The new roadway width on the bridge became 48 ft. curb-to-curb, while the old structure had only 18 ft. Two sidewalks and parapets brought the total width of the bridge to 62 ft. Twenty standard prestressed concrete boxes, three ft. wide and 21 ins. deep, surfaced with a minimum thickness of two ins. of bituminous concrete comprised the superstructure. The substructure consisted of two abutments and one pier, all on spread footings. The total length of the bridge from abutment to abutment was 84 ft., giving it two clear spans of 40 ft. each.

The preliminary bridge plan was submitted through the County Engineer to the New Jersey State Highway Department, Bridge Division, for approval. Upon receipt of such approval the final plans, specifications and cost estimates were prepared and the completed contract documents submitted to the County Engineer on June 30, 1958. In addition to the new structure, the plans called for some channel relocation, approach improvement and the relocation of a sanitary sewer. A temporary pedestrian detour was also specified as this bridge serves as a crossing for school children. Time for construction was estimated at about six months and the cost was approximately $150,000.

In the planning of a primary highway on a new alignment extensive takings of real estate are unavoidable and expected. However, in the replacement of a county bridge it is often neither practicable nor advisable to interfere with the adjoining properties. This requires exercise of ingenuity and judgment on the part of the designer, especially so if the new bridge happens to span a wide river whose bottom is composed of varved clay deposits about 100 feet deep, as was the case in the following project.

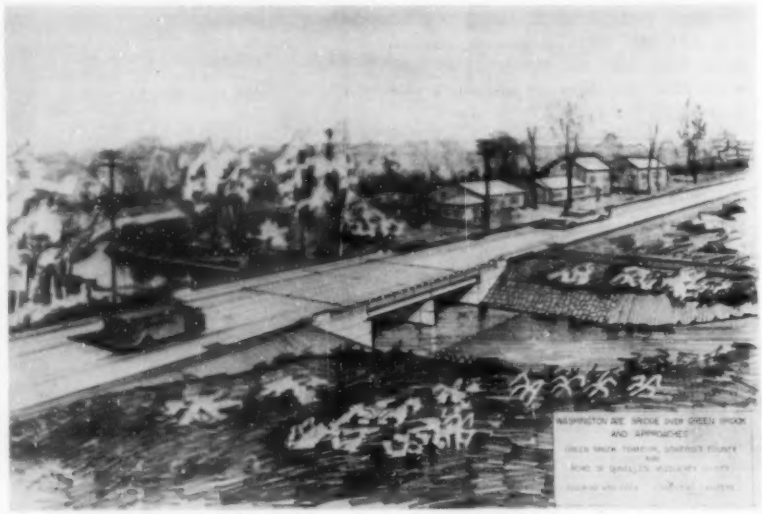
Boonton Road (Route 202) is carried over the Pompton River between Wayne Township on the Passaic County side and the Borough of Lincoln Park in Morris County. The existing structure was old, in poor condition and so narrow that the wise motorist waited to allow an oncoming truck to make the crossing first.

George Mason, Passaic County Engineer, in cooperation with Robert Curtis, Morris County Engineer, engaged Goodkind & O'Dea to prepare plans and specifications for the construction of a new bridge at this site. The federal government on recommendation of the New Jersey Highway Department designated this a secondary federal project eligible for 50 percent federal aid participation.

In the past that bridge had had a companion—a wooden trough-like structure which carried the old Morris Canal. On this "aqueduct" canal barges loaded with iron ore from northwestern New Jersey mines floated high over the Pompton River. Somehow the road bridge got to be called the Aqueduct Bridge and the name was transferred to the present project.

As a first step in determining the foundations for the new bridge Mr. Mason authorized the consultants to have borings taken at the site and undisturbed samples of the soil tested and analyzed in the laboratory. The waterway opening requirements were obtained from the Division of Water Policy and Supply. Mr. Mason's office made a survey of the entire location.

With all this material at hand, the designers prepared a layout and design sheet recommending a new structure and approaches as follows: The length of bridge to be 186 ft., of two spans of rolled steel beams with a concrete deck of composite construction, and a roadway width of 30 ft. Two sidewalks at six ft. each to make the total width of the bridge 42 ft. The two abutments and the pier to be founded on long steel H piles which penetrate the deep layer of varved clay and end up in a layer of compacted sand and gravel. The structure was designed to carry H20 S16 loading as prescribed by AASHO Specifications.



● **NEW BRIDGE of prestressed concrete has a total width of 62 ft. Span is 80 ft.**

Because of the heavy traffic using the bridge, including interstate buses, a temporary detour had to be provided during construction with a minimum disturbance of real estate at each end of the bridge. This was solved by a one-way timber trestle on timber piles located to the south of the new bridge. Coordinated traffic signals at the two approaches were installed and operated to suit traffic volume requirements.

Other Jobs

It is not only in the bridge field that the County Engineer can find aid from the Consulting Engineer. A variety of questions can arise which call for marshalling of the facts, and evaluation of causes and recommendations for action. A bridge may suffer damage from a

truck hitting the superstructure. A study can determine the extent of damage and the repairs needed. A motorist sues the county alleging that the state of a road contributed to an accident. The testimony of an engineer who had no connection with the construction of the road can be very helpful.

There are certain studies often made in conjunction with a master plan for a county that provide information of especial value to the county engineer. Working with a budget that is never large enough for all he would like to do, he must be very careful in choosing which roads shall be rehabilitated and in what order. The consulting engineer is in a position to develop sufficiency ratings for all the county highways and bridges and to provide a chronological program of renewal.

The location of a new major traffic artery, as an Interstate highway, in a county will generally call for a re-evaluation of the traffic pattern throughout the affected area. Here again the services of the consulting engineer can be of value, especially if he has planners on his staff who are qualified to forecast the probable population adjustments consequent on the coming of the new facility and the effect of these adjustments on the relative use of the existing county roads.

Because of the nature of his business the consultant covers a wide field and comes in contact with many county engineers and various state and federal agencies. He is thus in a position to advise the individual county engineer on methods of financing public works, particularly where aid can be obtained. The county engineer can find this information invaluable since it can be the decisive factor as to whether the project can be carried out or not.

A Building Sags

The consultant generally has specialists on his staff who can supply expert, independent advice to the county engineer.

As an example, one county had a building of which it was very proud. It had received State-wide notice as being the most up to date of its kind. However, after being in service only a couple of years or so, serious cracks appeared in walls and at the intersection of walls and floors. Some of these cracks opened to a width of two inches or more, causing alarm. It was imperative to have the cause investigated by an independent agency. The writers' firm was called in and put its qualified soils and foundation engineers on the job. Borings were made through the floors, and around the outside perimeter, down to and into the original ground. Tests were made of samples and studies made of underground drainage conditions. A thorough report was made, which embodied the findings as to the cause of the failure. The report was accepted by the County and used in action to recover damages from the responsible persons. The consultant was then asked to recommend what should be done to repair the damage and to prevent it from continuing. Various plans and processes were studied and the final one recommended included the construction of grout "Columns" under the floors combined with improved drainage of the subsoil.

What does the Consulting Engineer gain from his Association with the County Engineer?

First there is payment for services. Although it is true that the aggregate fees the consultant receives are smaller than he gets from working on large state or federal public works projects, the ratio of profit to outlay can be made satisfactory by careful budgeting and increased efficiency.

It is also true that the big element of repetition often present in jobs with long stretches of highway and many similar bridges is missing on county work. The consultant however, gains experience in solving a variety of difficult problems and his engineers through working on these projects obtain a wider experience and become more valuable as a consequence. By working with a few men of high caliber the consultant reduces the probability of costly errors. Decisions on policy and preference can be obtained quickly from county work because of the concentration of authority. The consultant also has an opportunity to become acquainted with State and Federal engineers which may result in additional requests for his services.

The foregoing are but a few examples which demonstrate that the association of the county engineer and the consultant can be one of mutual advantage, enhancing the professional standing of both.

● **AQUEDUCT** Bridge over Passaic River is 2-span, 186 ft. long, with two 6-foot wide sidewalks and a 30-ft. concrete roadway.

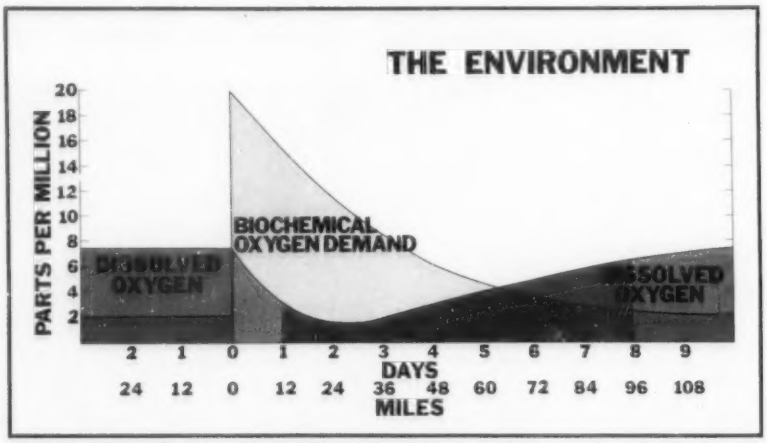
STREAM LIFE

and the POLLUTION ENVIRONMENT

ALFRED F. BARTSCH, Assistant Chief for Special Technical Services, and
WILLIAM MARCUS INGRAM, In Charge, Biological Field Investigations for Water Pollution Control,
Water Supply and Water Pollution Research,
Robert A. Taft Sanitary Engineering Center, United States Public Health Service, Cincinnati, Ohio

INCREASED field investigations over the past 10 years, directed toward the abatement of pollution, have prompted this pictorial presentation to show the impact of pollution upon the stream environment and in turn upon the stream life, or biota. The illustrations were developed initially for use in training sanitary engineers and supporting scientists at the U. S. Public Health Service's Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio.

To show schematically the effects of pollution on biota, raw domestic sewage has been chosen as the pollutant. With such a waste, the lowering of dissolved oxygen and formation of sludge deposits are the most commonly seen of the environmental alterations that damage aquatic biota. Fish and the organisms they feed on may be replaced by a dominating horde of animals such as mosquito wrigglers, bloodworms, sludge worms, rattailed maggots and leeches. Black-colored gelatinous algae may cover the sludge and, as both rot, foul odors emerge from the water and paint on nearby houses may be discolored. Such an assemblage of abnormal stream life urges communities not to condone or ignore pollution, but to abate it without delay. This biotic picture emphasizes that pollution is just as effective as drought in reducing the utility of a valuable water resource. They help to make clear that pollution abatement is a vital key to the over-all problem of augmenting and conserving waters of this land.



● **FIGURE 1. The assumptions in the hypothetical pollution case under discussion are a stream flow of 100 cfs, a discharge of raw sewage from a community of 40,000, and a water temperature of 25°C, with typical variation of dissolved oxygen and BOD.**

No two streams are ever exactly alike. In their individualism streams differ from each other in the details of response to the indignity of pollution. In the following paragraphs, and in the charts they describe, the hypothetical stream is made to conform exactly to theory, showing precisely how an idealized stream and its biota should react in a perfect system. In reality, of course, no stream will be exactly like this although the principles shown can be applied with judgment to actual problems that may be encountered.

ASSUMED CONDITIONS

The stage for discussion is set in Figure 1. The horizontal axis represents the direction and distance of flow of the stream from left to right. Time and distance of flow downstream are shown in days and also in miles. The vertical scale of quantity—or more accurately, concentration—expressed in parts per million, applies to dissolved oxygen and biochemical oxygen demand at distances upstream and downstream from the origin of the sewage discharge, which is identified as point zero. Here, raw domestic sewage from a sewered community of 40,000 people flows to the stream. The volume flow in the stream is 100 cubic feet per second, complete mixing is assumed, and the water temperature is 25°C. Under these conditions the dissolved oxygen (D.O.) sag curve reaches a low point after two and one-quarter days of flow and then rises again toward a restoration similar to that of upstream, unpolluted water.

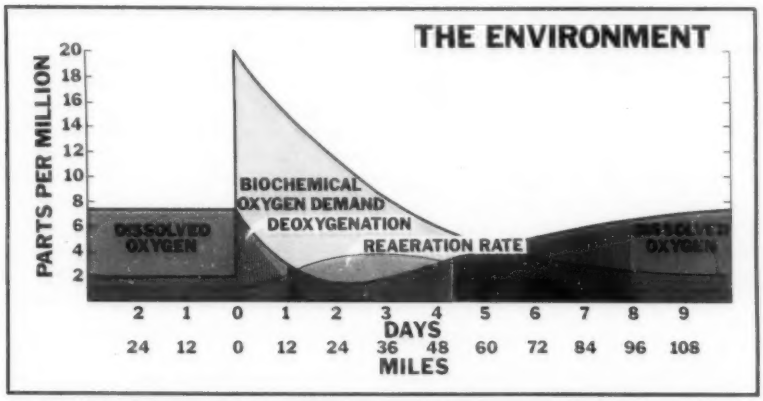
The biochemical oxygen demand (BOD) curve is low in upstream, unpolluted water, increases at point 0 from the great charge of sewage and gradually decreases from this point downstream to a condition suggestive of unpolluted water. BOD and D.O. are so interrelated that the dissolved oxygen concentration is low where BOD is high, and the converse also is true. Green represents clean water; orange, a zone of degradation; red, a zone of active decomposition; and blue, a zone of recovery.

EFFECT OF REAERATION

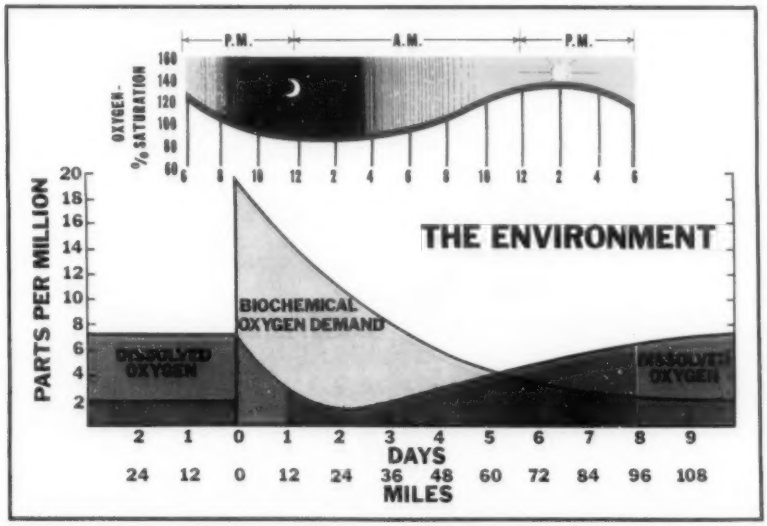
Figure 2 represents an interpretation of the two principal antagonistic factors that have to do with the shape of the D.O. sag curve. The biochemical and other forces that tend to exhaust D.O. supplies, called collectively the process of deoxygenation, would reduce such resources to zero in about a day and one-half if there were no factors in operation that could restore oxygen to water. The river reach where D.O. would be completely gone would occur about 18 miles downstream from the point of discharge of sewage from the municipality. However, with reaeration factors at work, there is appreciable compensation for deoxygenation, and in this way the actual contour of the oxygen sag curve is determined. Thus, the low point of the curve is not attained at one and one-half days of flow at mile 18 with a zero D.O., but in reality is reached at about two and one-quarter days of flow at about mile 27. The D.O. here does not go to zero, but to 1.5 ppm.

If the population of the city remains fairly uniform throughout the year, and the flow is relatively constant, the low point of the D.O. sag curve can be expected to move up or down the stream with fluctuations in temperature. In winter, one can expect to find the low point farther downstream than shown. In other seasons, if temperatures exceed the 25°C upon which the charts are based, D.O. will be depleted more rapidly and drastically with the low point farther upstream.

The reach of any stream where the D.O. sag curve attains its low point obviously is the stream environment poorest in D.O. resources. It represents a place where aquatic life that may need a high D.O. can suffocate or from which such life may move to other stream areas where the D.O. resources are greater.



● FIGURE 2. The dissolved oxygen concentration in the stream is partially destroyed by the pollution load. Full depletion is avoided by reaeration processes.



● FIGURE 3. Dissolved oxygen fluctuates according to available light, a result of photosynthesis. Thus, values on the lower curve are subject to daily variation.

EFFECT OF LIGHT

The upper graph of Figure 3 illustrates fluctuations of dissolved oxygen that may occur over a 24-hour period at a single point in a stream with average density of aquatic greenery such as planktonic algae or larger submerged plants. For sake of explanation, any point in the recovery zone would exhibit such diurnal D.O. variations. The lower graph shows only linear changes in D.O., and gives no indication of the daily variation in availability of this vital gas that may occur at any single selected point.

If this selected point is in the recovery zone at mile 72, one can see from Figure 3 that D.O. varies from a low of about 80 percent saturation at 2:00 a.m. to about 140 percent at 2:00 p.m. Diurnal variation such as this is a result of photosynthesis chiefly in algae but in other plants also. During daylight hours these plants give off oxygen into the water in such large quantities that if the organic wastes are not sufficient to use up much of the D.O. in oxidizing sewage, the water commonly becomes supersaturated at some time during daylight hours. In addition to giving off oxygen, the photosynthetic process results in the manufacture of sugar to serve as the base from which flows the nutritional support for all stream life. The process of photosynthesis can be illustrated schematically as:

$$6\,CO_2 + 6\,H_2O \rightarrow C_6H_{12}O_6 + 6\,O_2$$

This action proceeds through the interaction of the green pigment, chlorophyll, contained in living plant matter, of sunlight, carbon dioxide, and even water to form the raw materials into a simple sugar and surplus oxygen.

While photosynthesis occurs, so also does respiration which proceeds 24 hours on end irrespective of il-

lumination. In this well-known process O_2 is taken in and CO_2 is given off. The algae, during daylight may yield an excess of oxygen over and above their respiratory needs, the needs of other aquatic life, and the needs for the satisfaction of any biochemical oxygen demand. Under these conditions, surplus oxygen may be lost to the atmosphere. During hours of darkness photosynthesis does not occur and gradually, the surplus D.O. that was present is used up or reduced by algae, fish, various insects, clams, snails and other aquatic life in respiration, and by bacteria in satisfaction of the BOD. That is why oxygen resources are poorest during early morning hours. During hours of darkness, a stream is typically dependent on physical reaeration for its oxygen resources after exhaustion of the "bank of dissolved oxygen", that was elevated to supersaturation levels by aquatic plants.

Obviously, on stream sanitary surveys where organic wastes such as domestic sewage are pollutants, it is important to sample each station over 24 hours at intervals that are appropriate to reveal information on diurnal D.O. variations. If this is not done and station 1 is sampled consistently around 8:00 a.m. and station 6 around 5:00 p.m. over a weekly or a monthly survey, critical D.O. concentrations will not be found. If interval sampling over 24 hours cannot be done because of workday restrictions, reversing the time of sampling from the upstream to the downstream station on alternate days will at least show variations of D.O. that one can expect through an 8-hour workday.

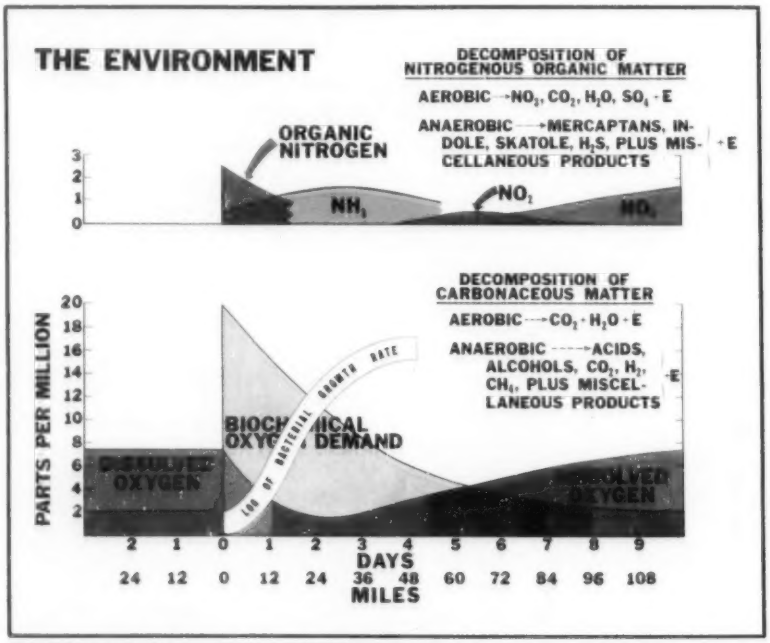
EFFECT OF ORGANIC MATTER

The bottom graph of Figure 4 illustrates reasons for the decrease in the BOD curve progressively downstream and offers an explanation for the depression in the oxygen sag curve. On this graph there has been superimposed, in white, the shape of the log curve of bacterial growth rate. Accelerated bacterial growth rate is a response to rich food supplies in the domestic raw sewage. During rapid utilization of food, bacterial reproduction is at an optimum, and utilization of D.O. becomes fairly proportional to the rate of food oxidation.

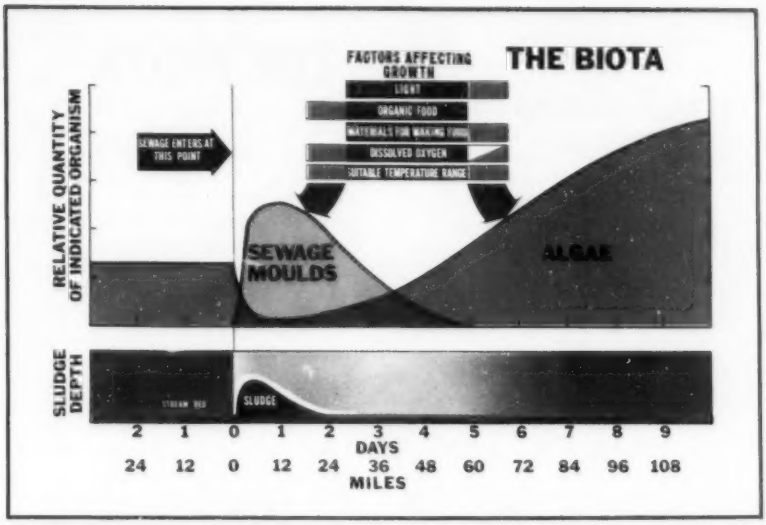
The upper graph illustrates, in principle, the progressive downstream changes in nitrogen from the organic form to the nitrate form. It demonstrates the initial high consumption of oxygen by bacteria that are feeding on proteinaceous compounds available in upstream waters in freshly discharged domestic sewage. With fewer and fewer of these compounds left in downstream waters, the BOD becomes reduced and the D.O. increases. Fat and carbohydrate foodstuffs rather than proteins could have been chosen just as well to show this phenomenon.

The nitrogen and phosphorus in sewage proteins can cause special problems in some receiving waters. Experience has shown that increasing the amount of these elements in water can create conditions especially favorable for growing green plants. In free flowing, clear, pebble brooks they appear as green velvety coatings on the stones or as lengthy streamers waving gently in the current. They are not unattractive and even, in the poetry of Nature, are complimented by the name "mermaid's tresses". These plants are not like the troublesome ones which occur mostly in more sluggish streams, impoundments or lakes, especially when they are artificially fertilized by sewage. In the clean brook, they not only are attractive and natural to see, but also they are a miniature jungle in which animals of many kinds prey upon each other with the survivors growing to become eventual fish food.

In more quiet waters, the algal nutrients in sewage are picked up for growth by less desirable kinds of algae. With great supplies of nitrogen and phosphorus made available, free-floating, minute blue-green algae increase explosively to make the water pea soup green, smelly and unattractive. In some unfortunate localities, nuisance blooms of algae have become so objectionable that waterfront dwellers have had to forsake their homes and see their property depreciate in value. The problem has been studied at a number of localities, and some studies are still in progress. Special legislation has even been formulated requiring that sewage treatment plant effluents not be discharged to susceptible lakes solely because of the algal nutrients they contain. Sometimes, under conditions not well understood, some blue-green algae develop poisons capable of killing livestock, wildlife and fish. Fortunately, such occurrences are rare. It is completely clear that sewage disposal and biological responses of even such lowly plants as algae go hand-in-hand sometimes to plague the desires of man.



● FIGURE 4. With a heavy influx of nitrogen and carbon compounds from sewage, the bacterial growth rate is accelerated and dissolved oxygen is utilized for oxidation of these compounds. As this proceeds, food is "used up" and the BOD declines.



● **FIGURE 5. Shortly after sewage discharge, the moulds attain maximum growth. These are associated with sludge deposition shown in the lower curve. The sludge is decomposed gradually; as conditions clear up, algae gain a foothold and multiply.**

AQUATIC PLANTS

In the lower part of Figure 5 a profile is shown of the water and stream bed with the vertical scale of the latter exaggerated. Sludge deposits begin to accumulate just below the point of sewage discharge. These deposits reach their maximum thickness near the point of origin but blanket the stream bed for many miles downstream. The substance of the deposits gradually is reduced by decomposition through the action of bacteria, moulds and other sludge-dwelling organisms, until it becomes insignificant about thirty miles below the municipality.

Also, at the outfall the water is turbid from fine solids held in suspension in the flowing water. Larger floating solids, destined to sink eventually to the stream bed as settleable solids, are visible on the water surface as they drift downstream. Both the fine and large solids contribute to the sludge deposit, and as they settle progressively to the bottom of the stream bed, the water becomes clear and approaches the color and transparency of upstream water above the point of sewage discharge.

The upper graph illustrates the relative distribution and quantities of algae, various moulds, and filamentous bacteria such as *Sphaerotilus*. From mile 0 to mile 36, high turbidity from floating debris and suspended solids is not conducive to algal production. Thus, except for slimy blue-green marginal and bottom types, algae are sparse in this reach. In order to grow well algae need sunlight, and here it cannot penetrate the water effectively. Also, floating solids that settle out of the water carry to the bottom with them floating algae that drift into the polluted zone from clean water areas upstream.

Blue-green algae that may cover marginal rocks in slippery layers and give off foul odors upon seasonal decay masquerade under the names: *Phormidium*, *Lyngbya*, and *Oscillatoria*. Green algae that accommodate themselves to the putrid zone of active decomposition frequently include *Spirogyra* and *Stigeoclonium*. *Gomphonema* and *Nitzschia* are among the diatoms that are present here.

Algae begin to increase in numbers at about mile 36. Plankton, or free-floating forms, steadily become more abundant and reach their greatest numbers in algal blooms some 40 to 60 miles farther downstream. This is where reduced turbidity, a lack of settleable sewage solids, final mineralization of proteinaceous organics to nitrate-nitrogen fertilizers, and favorable oxygen relations result in an ideal environment for growth of abundant aquatic plants.

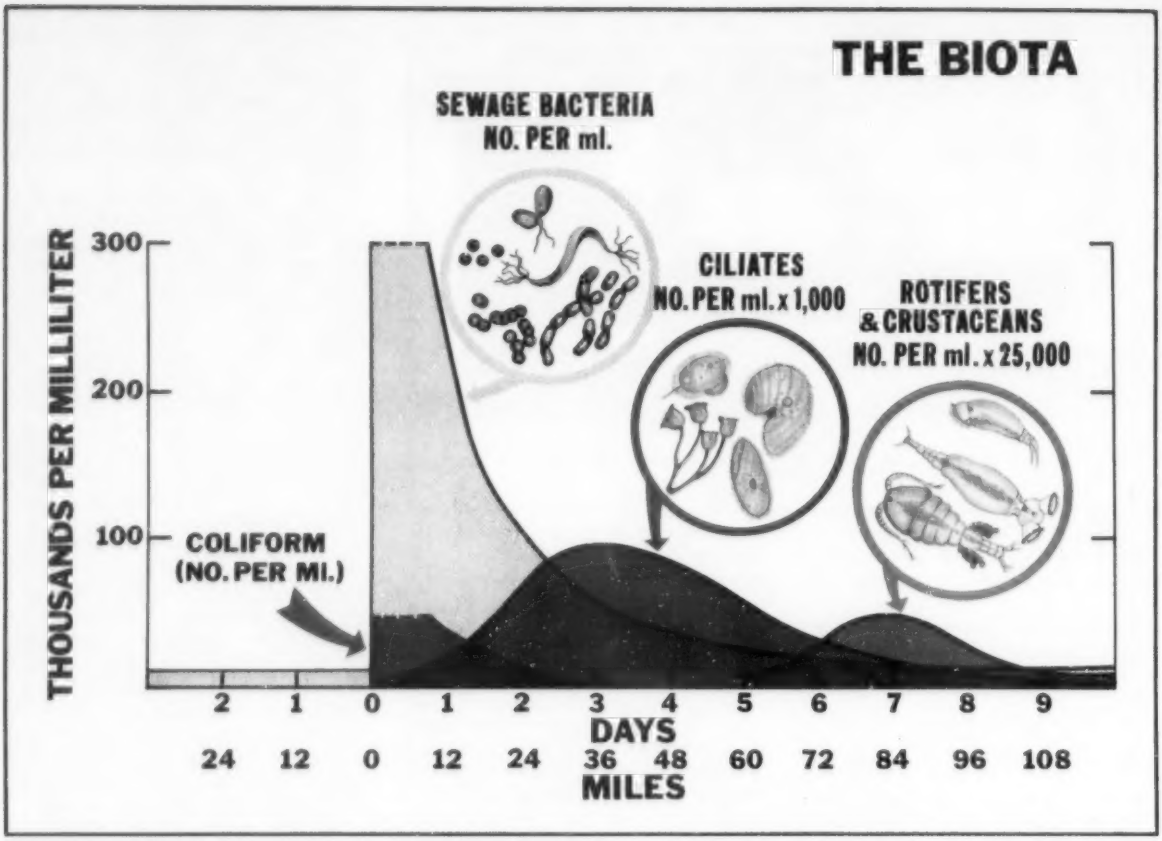
Algae that may be found abundantly here may be represented by the bluegreen genera *Microcystis* and *Anabaena*; the pigmented flagellates are represented by *Euglena* and *Pandorina*; the green algae by *Cladophora*, *Ankistrodesmus*, and *Rhizoclonium*; and diatoms by *Meridion* and *Cyclotella*. Rooted, flowering, aquatic plants that form underwater jungles here are represented by the "water pest", *Elodea*, and various species of pond weeds known as *Potomogeton*. Such aquatic forests and meadows present an excellent natural food supply for the aquatic animals, and also serve them with shelter. Thus, commonly as plants respond downstream in developing a diversified population in the recovery and clean water zones, animals follow a parallel development with a great variety of species. In such reaches where the stream consists of numerous alternating riffles and pools, a great variety of fish are likely to occur.

In the reach where algae are scare, from about mile 0 to mile 36, various moulds and bacteria are the dominant aquatic plants. *Sphaerotilus* filaments may abound in riffle areas at about mile 36 where physical attachment surfaces are available and where oxygen, although low, is adequate. Bacterial slimes may cover rocks and other submerged objects and bank margins. Such slimes have an abundant supply of available food in readily usable form of carbohydrates, proteins and fats and their digestion products. They are not bothered especially by high turbidities or by settleable solids. They do well living in the center of sludge or near it, in what to them is an "apple-pie" environment.

BACTERIA AND THE CILIATES

Associated with the bacterial slimes are certain ciliated protozoans that feed on bacteria and engulf small particles of settleable organic matter. Such ciliates are also found in aeration tanks of sewage treatment installations as a component of activated sludge and on the surface of rock in trickling filter beds. Common ones are *Epistilis*, *Vorticella*, *Colpidium*, and *Stentor*.

Figure 6 illustrates the interrelations between bacteria and animal plankton, such as ciliated protozoans, rotifers and crustaceans. The quantities shown and the die-off curves for sewage bacteria *in toto* and for coliform bacteria separately



● FIGURE 6. Bacteria thrive and finally become prey of the ciliates, which in turn are food for the rotifers and crustaceans.

are theoretically accurate. The blue curve for ciliated protozoans and the green curve representing rotifers and crustaceans are more accurate in principle than in actual quantities.

After entering the stream as a part of the sewage, bacteria, including coliforms, reproduce to become abundant in an ideal environment. Here they feed on the rich organic matter of sewage and by multiplying rapidly offer a ready food supply for ciliated protozoans which are initially few in number. After about a day of flow the bacteria may be reduced through natural die-off and from the predatory feeding by protozoans. After about two days of flow, the stream environment becomes more ideal for the ciliates, and they form the dominant group of animal plankton. After seven days, the ciliates fall victim to rotifers and crustaceans which represent the principal microscopic animal life in the stream.

It has been long suspected that the efficiency of this sewage-consuming biological machine depends upon a close-knit savage society in which one kind of organism captures and eats another. Classical research of some time past showed that a single kind of bacterium mixed with sewage in a bottle could not do an efficient or rapid job of breaking down the sewage. Several kinds could do a better job, supposedly because one bacterial type, in acting upon parts of the sewage as food, prepared it for acceptance by another. With several bacteria a multilateral attack was made possible. But even a system like this is inefficient. Bacteria work best only when they are growing rapidly and they do this when they multiply frequently by splitting into two. It is important then that they not be permitted to attain a stable high and lazy population. In the bottle the task of stabilizing sewage goes most rapidly when ferocious bacteria-eating ciliates are introduced to keep the population at a low and rapidly growing state.

These relations between the bacteria eaters and their prey, discovered in the bottle, apply as well to efficient functioning of a modern sewage treatment plant. In some sewage treatment plants, examination is made routinely to see how the battle lines are drawn up between the bacteria eaters and their prey. It now becomes more obvious why sewage disappears so efficiently from the stream. It also is clear why the bacteria, the ciliates, the rotifers and the crustaceans increase, persist for awhile, and then decrease along the course of passage of the stream.

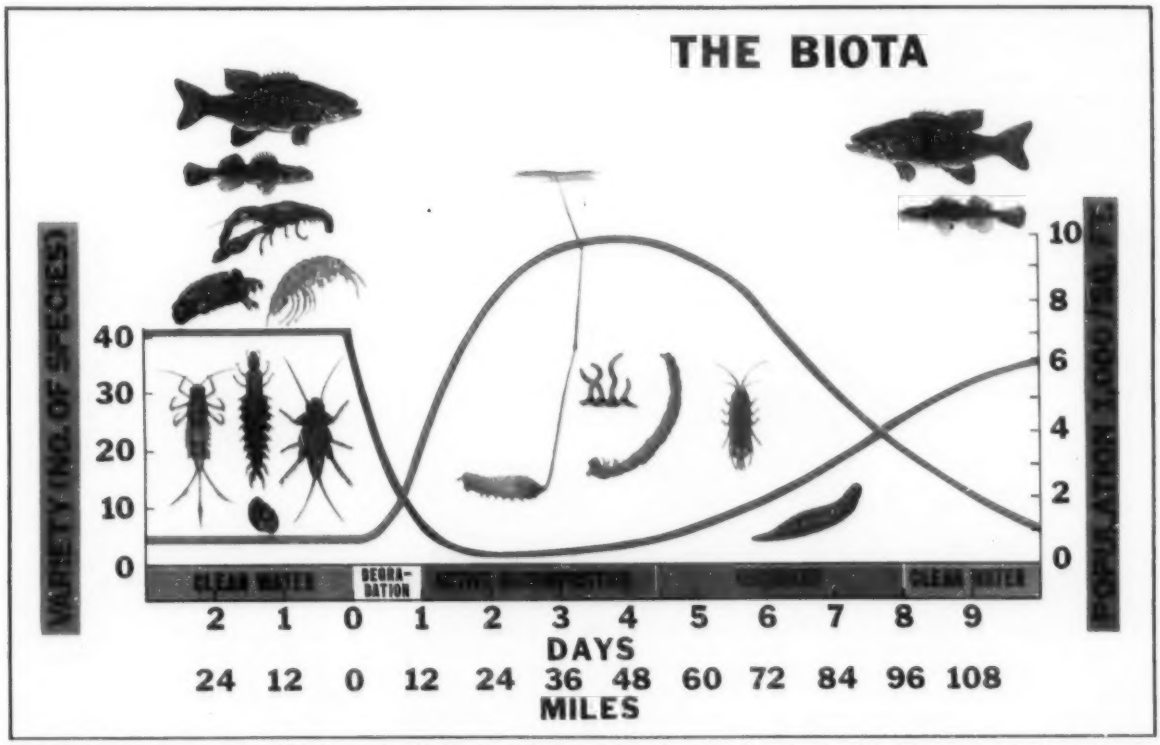
THE HIGHER FORMS

Figure 7 illustrates the types of organisms and the numbers of each type likely to occur along the course of the stream under the assumed physical conditions that were stated earlier. The green curve represents the numbers of kinds or species of organisms that are found under varying degrees of pollution. The orange curve represents the numbers of individuals of each species. In clean water above the city a great variety of organisms is found with very few of each kind repre-

sented. At the point of waste entry the number of different species is greatly reduced, and they are replaced by a different association of aquatic life. This new association demonstrates a severe change in environment that is drastically illustrated by a change in the species make-up of the biota. However, this changed biota, represented by a few species, is accompanied by a tremendous increase in the numbers of individuals of each kind as compared with the density of population upstream.

In clean water upstream there is an association of sports fish, various minnows, caddis worms, mayflies, stoneflies, hellgrammites, and gill-breathing snails, each kind represented by a few individuals. In badly polluted zones the upstream association disappears completely or is reduced, and is replaced by a dominant animal association of rattailed maggots, sludge worms, bloodworms and a few others, represented by great numbers of individuals. When downstream conditions again resemble those of the upstream clean water zone, the clean water animal association tends to reappear and the pollution tolerant group of animals becomes suppressed. Thus, clean water associations of animals may form parameters around polluted water reaches. Such associations may be indicative that water is fit for multiple uses, while the presence of a pollution tolerant association of animals indicates that water has restricted uses.

Pollution tolerant animals are especially well adapted to life in thick sludge deposits and to conditions of low dissolved oxygen. The rattailed maggot, *Eristalis tenax*, is not dependent on oxygen in water. This animal shoves its "snorkle-like" telescopic air tube through the water surface film to breathe atmospheric oxygen. Thus, even in the absence of oxygen it is one of the few survivors where most animals have suffocated. Those who have worked around sewage treatment installations have probably observed the flesh or milkish colored rattailed maggot in the supernatant over sludge beds where dewatering performance was poor. Commonly associated with it in this supernatant over sludge beds are the immature stages of the well-known "sewagefly", *Psychoda*, and wrigglers of the sewage mosquito, *Culex pipiens*. The rattailed maggot turns into a black and brownish banded fly about three-quarters of an inch long, called a "bee fly" because it closely resembles a bee. It differs by having two wings instead of four and does not sting. Sludge worms, *Tubifex*, are dependent upon the dissolved oxygen in water; however, they are well adjusted to oxygen famine and commonly are found in water with as little as half a part per million. They are actually aquatic earthworms, cousins of the terrestrial earthworms found in lawns and used as fish bait. These worms feed on sludge by taking it into the digestive tract. In passing it through their alimentary canal, they remove organic matter from it, thus reducing the biochemical oxygen demand. Sludge worms one and one-half inches long and as thick as a needle have been observed to pass fecal pellets totaling five feet nine inches through the digestive tract in 24 hours. Fecal pellets that are extruded from the anal openings have on occasion been found to have a biochemical oxygen demand of one-half of that of sludge that was not "worked-over" by them. The sludge worms are then, "actually crawling BOD", in that they incorporate sugars, proteins and fats that are present in sludge into their body cellular components. It may be difficult to visualize the magnitude of BOD removal that one worm, needle-thick in size and one and one-half inches long, can accomplish in relation to an extensive sludge deposit. However, when it is realized that from 7,000 to 14,000 of these worms may be found per square



● **FIGURE 7.** The green curve shows the fluctuations in numbers of species; the orange, the variations in numbers of each.

foot of bottom surface in sludges, considerable work is done in removing BOD. By the same token, for example, wrigglers of sewage mosquitoes, *Culex pipiens*, that feed on the organics of sewage and emerge as adults to fly out of water represent BOD removed. In this instance it is "flying BOD" that is factually taken out of water, whereas the crawling BOD of sludge worms is not removed, but is recycled back as the worms die.

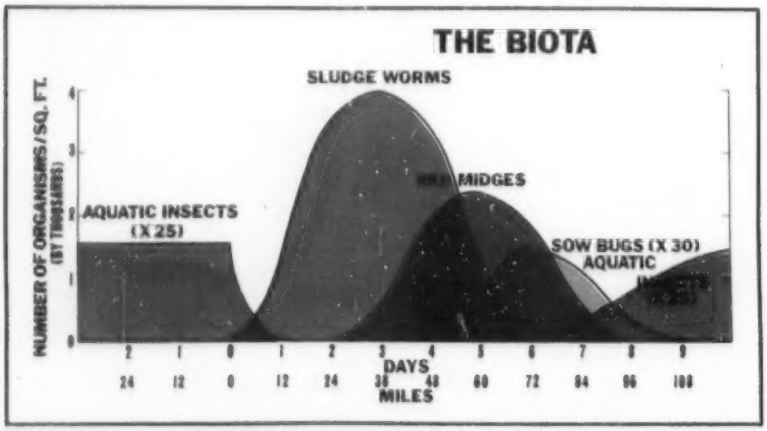
The worm-like body of organisms composing the pollution tolerant association of the rattailed maggot, sludge worms, blood worms, and leeches is an ideal type to have for successful living in sludge. As settleable solids fall to the bottom, such organisms are not trapped and buried in them to die, but by wriggling with their worm-like cylindrical bodies, manage to maintain their position near the surface of sludge in communication with the water interface. Sow-bugs that are shown in Figure 7 with the "wormy-horde" do have well-developed appendages, but their life may be marginal on stream bank areas and on the surface of rocks protruding from sludge covered bottoms. Thus, they are not buried by settleable solids.

The invertebrates shown in clean water do not form successful populations in streams where settleable solids sink to form sludge deposits. Because their appendages may become clogged with sludge as solids settle, they may be carried readily to the bottom and be buried alive.

POPULATION FLUCTUATION

Figure 8 shows that the population curve of Figure 7 is actually composed of a series of population maxima for individual species. The species form a significant pattern in reference to each other and to the varying strength of the pollutant as it decreases progressively downstream. Sludge worms such as *Tubifex* and *Limnodrilus* can better withstand pollution than other bottom invertebrates. Thus, they reach great numbers closer to the source than other bottom dwelling animals. In turn they are replaced in dominance by red midges, also called bloodworms or *Chironomids*, and then by aquatic sow-bugs, *Asellus*. The sludge worms and red midges are so numerous in contrast to the other organisms shown in Figure 8 that numbers of the latter are exaggerated 25 and 30 times to permit showing them effectively. Finally, when the effects of pollution have largely subsided in the environment, a variety of insect species represented by few individuals of each dominates the bottom habitat.

The story of pollution told here emphasizes that stream pollution and recovery may follow an orderly scheme under the influence of interacting physical, chemical and biological forces. Using streams as dumping places for sewage triggers the environmental and biotic changes that have been shown. These changes are not desirable. In most cases, in addition, they are hazardous to public health and otherwise impair the usefulness of valuable water resources. The needed remedy is to confine all of these interacting forces in an acceptable sewage treatment works so that this example of the Nation's water resources is protected for present and future use.



● **FIGURE 8. The population curve of Figure 7 is composed of a series of maxima for individual species, each multiplying and dying off as stream conditions vary.**

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DOES YOUR UTILITY HAVE A SUCCESSFUL SAFETY PROGRAM?

A good safety program starts with effort and finishes with heart and organization. Here is an outline of a program that will work for you.

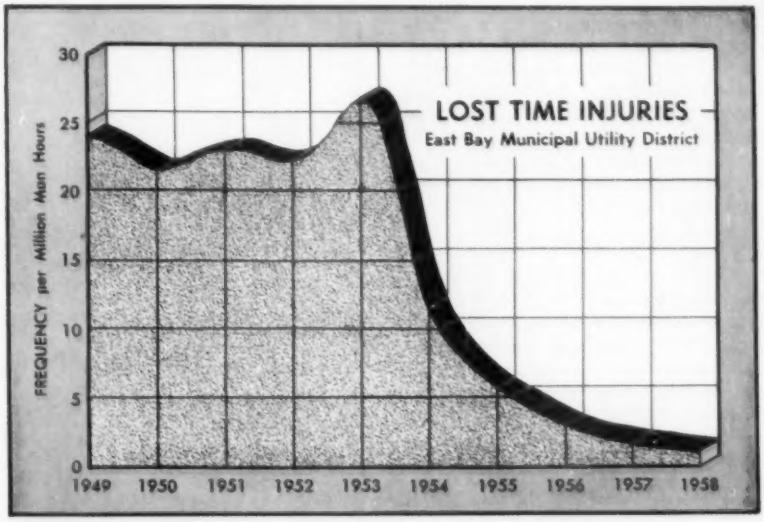
ARTHUR J. WEBB,
Safety Coordinator,
East Bay Municipal Utility District,
Oakland, California

A SAFETY program can be made to succeed in any utility that is willing to organize a specific program and to coordinate the efforts of management, supervision and employees into the plan. There are as many types of safety programs as there are utilities who have them. The type of program is not half as important as the effort and the honest endeavor of all concerned. This article is designed to cover the elements and refinements of a program that will work in any utility where it is used.

It has been only in the past ten years that safety programs have taken a real foothold with water utilities. In California more than sixty utilities have started programs since 1955. As a result of these efforts, the compensation insurance rate for water utilities in California has dropped from $2.26 per $100 payroll to $1.48. This drop in rate almost coincides with the safety effort in the California Section of the AWWA to reduce injuries.

The apparent burden on industry, which was forced to begin safety programs, turned out to be a blessing. Not only did many corporations reduce medical and compensation costs but they found that production was helped. Morale was increased and industry developed a heart. Industry found that the most wonderful thing about being a "nice guy" was that it was also good business and saved the important dollar. Small industries shared the lead of the large ones.

The first and most important part is acceptance of the responsibility by the utility. The next is to select a man in the organization to head this activity and to lay out a plan for the program. He must know the causes of accidents in the particular plant or utility and devise a method of education. The plan will vary with the size of the company and the type of work that is done. Obviously a company that is composed only of servicemen and office personnel will need a different plan than one doing its own pipe installation and maintenance.



● **STRIKING RESULTS produced by the "grass roots" safety program of the East Bay Municipal Utility District is indicated by a drop in lost-time injuries from a peak of 23 per million man-hours worked to a low of 1.7 during the past 5-year period.**

The first responsibility lies in the hands of the general manager. There is no such thing as a safety program without the wholehearted and individual interest of the top man in the organization. He must declare to all concerned that safety will become a part of the every-day work. He must reveal who is responsible and who is answerable for safety. The details of what will be expected from department and division heads are his responsibility to voice as well. It soon becomes known whether the manager is sincere in his desire to promote safety, is starting a program to appease an insurance company or is merely trying to do the popular thing. The resulting attitude of division heads is clearly reflected in the subsequent attitudes and safety achievements of their respective divisions.

Leadership Qualities

Safety is not a job for just anyone. There are special qualities that must be sought. The leader must be capable of organizing and carrying out a plan; have leadership ability; be not overly proud; and be patient. He should love people and have compassion for them; but he should remain realistic and be able to understand differences in people. The

size of the company and the available personnel for the job are limitations in the selection of the man in charge of the safety of the personnel. Safety is a way of life and the safety supervisor must be a man who is willing to dedicate himself to helping men and management come to this understanding as a team.

A safety man does not need to be an engineer; many feel that it is better if he is not, since this eliminates professional conflict. It is not necessary to give the safety department power to stop jobs or to be a policeman. The safety head is a staff man who is supposed to lead the men and foremen to safer work attitudes and surroundings, not to beat them into submission. The safety supervisor looks for trouble and helps the foremen and department heads see the trouble before it causes an injury. Actual safety responsibilities belong to the line supervision.

Sources of Plans

There are several good sources for learning how to start and organize a safety program. Each is essentially the same in the procedure it recommends for safety program organization. One of the finest is the "Safety Manual, M3" printed and distributed for the benefit of water works organizations by the AWWA. Another is the "Accident Prevention Manual" published by the National Safety Council. Each of these outlines the entire organization of a safety program and implements that program with a complete text of suggestions on special hazards in industry. The "M3 Manual" deals particularly with the water industry.

Basic Precepts

Common sense and experience have led to the following fundamental ideas of accident prevention: 1) Men do not want to be injured; 2) accidents are caused; 3) accidents are mostly caused by people, not working conditions; and 4) men will work on their jobs in the manner that the voice of authority tells them to. This means that they will even place their lives in jeopardy because they fear loss of jobs more than they fear the hazard. They would rather risk injury than loss of jobs.

There are some essentials that lead to this understanding and the resultant control. To do this a team including all levels of employees must be developed. The men and the foremen must learn how accidents occur and how to prevent them. Management helps in this through specialist assistance in engineering, organization, statistics and training. Foremen must be helped to assume leadership. They must actually become the voice of authority, and must be respected as such. Making foremen responsible for safety in their areas is an important step in this direction.

In order to develop knowledge, leadership and team work, the management must find a method of teaching and communicating the ideas they know the men must eventually embrace. One of the best methods known is to help men to apply their lessons to themselves personally. Instead of developing the attitude that "accidents never happen to me because I work safely" or "accidents only happen to the other guy," the correct teaching methods will result in the idea that "This means me." Here are some ways to do this.

The regular ways used by almost every safety organization include use of bulletin boards and posters, holding meetings where films are used, first aid training sessions, inspections of job hazards and use of safety equipment (hard hats, safety shoes, eye protection, etc.). All of these things help but they do not do enough to make the man feel that "safety is for me."

One more idea that belongs here is that safety based on fear is wrong. Men who work in fear are not safe workers. They are in a constant inner turmoil. And yet there is always a right way to do the job. When the right way is known the worker will be safer because he has confidence.

New men on jobs and old men on new operations are among the greatest sources of accidents. They often work in fear and ignorance. When they have learned the job well, they will be less inclined to have job injuries.

Committees on the job where foremen and employees cooperate to study their jobs and working habits, are extremely helpful. Teamwork is developed, and men who know the job best are working together to eliminate the hazards where they are happening and as they arise. A committee arrangement is good because it makes safety discussions formal. It requires the committee to make a written record of the hazards of the job and the things that are being done to eliminate them. Top management can see the problems of the working crews and the corrections needed. Committees serve as training media for all employees who eventually serve as committee members. The foremen who act as committee chairmen learn more about being leaders and the men look to them for that leadership.

● **ACCIDENT STUDY groups bring safety problems closer to the men. The aim of the discussion is to learn accident prevention methods rather than to fix the blame.**

Tailgate Conferences

A device that has been used for many years is proving to be one of the best educational methods ever developed. This is the "tailgate con-

ference." Some of the water companies have called them "pipeline conferences." In these the coordinator of safety furnishes foremen and supervisors with a short printed weekly discussion of some safety problem. An example of this could be: "Hazards for men who are working with hot lead for pipe joints." The foreman is required to discuss this subject with his crew in his own way, using the material furnished or not, but including all of the points covered. Some foremen also have one of the crew study the material and discuss it at a crew meeting. In our Utility District, the Safety Coordinator plans the entire year's subjects before the beginning of the year and distributes the outline to each foreman or supervisor. Knowing ahead of time what subjects will be discussed, the foremen can plan to include special subjects of their own as they see the need. The outline serves only to help them get a meeting started. If they have problems of their own, such problems take precedence in the discussions. The weekly tailgate sessions need take only five to fifteen minutes a week, but it is important that they be held regularly at weekly intervals.

The value of tailgate or pipeline conferences lies in the fact that discussions of safety problems are encouraged. They become a habit on the job. The foreman becomes the voice of management by telling the men how the job should be done. The men have a chance to ask questions and discuss their problems. Leadership and teamwork are developed.

Accident Studies

In the past there has been a strong tendency for management to study accidents through review boards and then issue orders about how to work safely. Many times this was done with the best intentions but with a corresponding lack of educational contact for the men who have to do the job. Men felt that they were branded as stupid in their work. Accident review boards naturally placed the blame on someone. In many cases, the results of the findings were then used as a foundation for discipline. The accident review boards got the unsavory reputation of being "kangaroo courts." There was a tendency for this attitude even when sympathetic workmen were part of the review board.

An analysis of the use of accident review boards reveals that management men have been trying seriously to learn the causes of accidents. Management has furnished the conscience and motivation power. They have learned that most accidents are caused by unsafe acts of human beings who have many problems. They have learned that men resist being pushed around, but these same men want to learn how to protect themselves. Yet, when men are told what causes accidents and how to protect themselves, they do not always believe what they hear.

A man who learns from his own experiences learns best. If he learns from what he discovers rather than from what he is told, he will believe it better. Instruction with follow-up by a supervisor is only second best to personal experience.

With this in mind, our Utility District found a new way to study accidents. Briefly, the method is to require that crew and foremen sit down together immediately following the occurrence of an accident and talk it over with the man who was injured. They analyze the process, tools and conditions surrounding the accident, coming to an agreement about the source of the accident. They write the cause on a report form furnished for this purpose, making recommendations to prevent the same type of accident from recurring. The supervisor reviews the foreman's report, endorsing it with his opinion. He forwards it to the department head who studies it and forwards it to the Safety Unit. In this way, everyone has a chance to know what happened and how it is going to be corrected. If the department head or the Safety Unit feels that the situation calls for special assistance they can get it from an engineer or a hygienist; or lacking agreement with the analysis, either can meet with the study group to learn more of the cause of the accident and to help the men come to a better understanding of it. The men have a voice in their own safety and are responsible for making the primary decisions.

Many people felt that employees would not say things that would make them look bad. The results of this method gave management a new look at employees. Employees approach this method objectively and are glad to have their chance to be heard. While they have arrived at the same conclusions that the accident review boards have in the past, there is this advantage: They did it, not someone else, and they believe in it. Employees teach themselves; yet there is a loose control from above. When there is a sign that men are out of line in their thinking, management can step in and ask timely questions to point out the correct signposts.

The value of this approach lies in the fact that foremen are truly made the leaders of their men. They handle the accident study group. They are the ones who have to answer the questions that arise from the men. The foreman is led into leadership by his own men and becomes the

● **TAILGATE CONFERENCE, held each week by utility crew, lasts for five to fifteen minutes. Foremen are provided with general outline but may cover other items.**

voice of authority. The team becomes the agent for discovering the signposts to safer work.

Automobile Accidents

We have learned to use the same system for studying automobile accidents. Where once men fought solely to keep their records clean before an accident review board, they are now discussing the elements of defensive driving among the crew members.. A decision to classify accidents as "preventable" or "non-preventable" has developed more meaning than the old "at fault" terminology. Where once there were only four or five men studying accidents in the District over a year's time, there are now about three hundred who have a chance to sit down and discuss defensive driving principles. Our accident study groups look only for the defensive and survival factors. Legal implications are forgotten in favor of the survival factor. It does not matter who got a citation from the police, but rather what our employee could have done to foresee and prevent the accident from occurring.

With the use of the accident study groups consisting of the men and their foremen, only occasionally is it necessary for management or the safety personnel to enter the picture. When they do, they both learn more about the particular accident. Management becomes a guide and not a whip. The decision of the accident study group cannot be changed by anyone except the group.

That management does not care if the accident was preventable or not was a hard lesson to learn. The men must arrive at their decision because they believe in it; and only the men and the foremen can make any change in the decision that goes into the record. This gives the program meaning and forces the men to accept their responsibility. When the accident study group apparently errs in its decision, it shows where there is a need for training. Then management can enter the situation and provide special education and guidance to the accident study group.

Men are not discharged by the decisions of the study group; legal cases do not depend on the decisions. The study is for education alone. The decisions give management a guide to their educational problems with certain individuals. They then must work with foreman, supervisor and department heads to correct an erring driver or group. If the men can be led to correct habits, that is the objective; if not, the problem driver must be relieved of his driving responsibilities.

Overall Results

During the past five years the injury rate for our Utility District has dropped from 23 lost time injuries per million man hours worked to 1.7. The insurance rate for our compensation insurance has dropped from $2.26 per hundred dollars payroll to $1.03 per hundred. In addition, there have been close to $400,000 recovered from the insurance company because of the reduction in total injuries and the related costs for compensation and medical payments to our employees.

These results have shown that men do not want to have accidents and that education is the source of accident reduction. Results come from cooperation and not police action.

Long Beach Combines Tour and Teaching to Improve Sweeper Operations

As part of a comprehensive effort to improve the efficiency of its street sweeping operations, a unique training program conducted by Long Beach, Calif., took the form of classroom work, machine demonstrations and a tour of a local sweeper manufacturing plant.

Two Saturday sessions were attended by all the personnel operating city street sweepers, street and sanitation supervisory personnel, maintenance personnel, mechanics responsible for special equipment, and a number of potential special equipment operators. Wayne Manufacturing Co. and Brown-Bevis Industrial Equipment Co. provided the technical personnel, transportation, service manuals and outlines for the two-day school.

The first phase of the program was a visit to the Wayne plant in Pomona, Calif. During the tour the group inspected all component parts of sweepers while in the process of assembly. Wayne engineers guided the students in small groups, taking ample time for discussion of the questions brought up by the inspection trip.

The second Saturday of the program was held in the Long Beach sanitation yard. Regular classroom work was conducted on standard Wayne machines which have been used by the City of Long Beach for all normal street sweeping operations for a number of years. Through the use of outlines, movies, slide films and literature, sweeper operation and maintenance was fully covered. Sweeping techniques were described in detail and many of the fine points of operation were explained.

City sanitation officials were well pleased with the results of the school, which helped to improve the skill of present operators and to develop a backlog of trained personnel for the future.

Refuse Disposal Now—Street Maintenance Later

● **DISPOSAL of 20 tons of refuse daily at a sanitary landfill keeps this International Drott TD-9 Skid-Shovel busy only part of the time, so the Public Works Dept. of Morehead City, N. C., uses it for street construction and maintenance too.**

● **FEATHERING** out at a road intersection. Addition of rubber increases adhesion and on a majority of the 33 roads resurfaced in past two years no tack coat was used.

RUBBER ROADS
REQUIRE LITTLE MAINTENANCE

JOHN J. ZABLOTNY,
Superintendent of Highways,
Town of Cheektowaga, New York

ON FEBRUARY 19, 1959, the Buffalo Evening News headlined an article as follows, "Winter's Damage to Roads Reported Worst in Years." The article continued, "The winter's damage to area roads has been the heaviest in years. A survey of highway officials finds them in general agreement that continued cold, more snow, deep frost and a pattern of alternating freezing and thawing, has taken a toll of the roads under their jurisdiction. It will call for major repair operations this spring."

And yet that same article quoted me as saying, "While the Department may have to borrow more money for salt, cinders and sand, road damage has not been unusual this year."

This statement could be made in spite of the fact that our town, located on the lee side of Lake Erie, is subjected to newsworthy winters. The snowfall for the 1958-59 season was over 100 inches. Round the clock operation of heavy snow removal equipment and the tearing action of tire chains means shorter life for any pavement. But in Cheektowaga, the reason I was able to say something different from the rest of the highway superintendents, was because our rubber roads are standing up better than ordinary black-top.

The Town of Cheektowaga is just east of Buffalo in Erie County, New York. It is bounded on the east by Transit Road, an historic road because in 1798 it was established out of virgin forest by the striking enterprise of running a meridian line north and south across the entire state. This line was run by transit, not by compass. Today, Transit Road (NY 78) is still one of the most important traffic arteries in New York State. It is significant that Transit Road was resurfaced last summer with rubber being used in some of its sections.

Cheektowaga's 600 streets total over 200 miles and they service the Buffalo Municipal Airport as well as 60 percent of the east-west traffic entering and leaving the city of Buffalo. Its industries are diversified —stone quarries serve several ready-mixed concrete plants; heavy steel fabricators supplement Buffalo steel industry; and manufacturers of electrical and mechanical equipment supply world markets. All of this means severe loading of our streets and highways.

Several years ago, in order to give our citizens better roads and to reduce maintenance costs, we started putting rubber into our bituminous road mixes. Over the past three years we have surfaced over brick, concrete, new penetration base and old black-top. Over any of these bases, the addition of the right type of rubber has very definite advantages.

Types of Rubber

Of the three types of rubber—natural, synthetic and reclaim, we chose a reclaimed rubber powder because it does the job at the lowest cost. The U. S. Rubber Reclaiming Co., a local industry, has engineered a devulcanized rubber powder called Ramflex to be used specifically in black-top mixes. The addition of Ramflex to the ordinary black-top mix does not entail any extra trouble. The rubber powder is added to the hot stone or sand and filler at the pug mill, the proportion being about 6 to 8 pounds of rubber to the ton, and is mixed for 10 seconds. The asphalt is then added and mixed in for an additional 20 to 30 seconds. Now it is ready for trucking to the road resurfacing area.

During the last two years we have resurfaced 33 streets with rubber. The majority of this mileage has been done without a tack coat because we have found that the addition of rubber to the raw black-top increases the adhesion of the surface mixture to the base. Further, the adhesion of the asphalt to the

● ADDING rubber to the mix permits the roller to follow closely behind the spreader with quick opening to traffic.

● IT IS EASY to add the Ramflex to the mix. Only 6 lbs. per ton of aggregate are needed and this is added directly.

aggregate is vastly improved. In addition, the rubber reduces warm weather bleeding and, in turn, our pavements, particularly at intersections, do not "shove." Also, a pavement that does not bleed is safer because the tendency of an automobile to skid has been greatly reduced.

From the paving construction point of view, the addition of rubber to the mix allows the roller to be used much sooner after the spreader. This means that we can get the street back into service more quickly than ever before. The Ramflex roads are very rich and black looking, and the residents of these streets report that the streets seem to stay cleaner.

In general, we have been able to effect a considerable saving for our town because, by using the rubber in the hot asphalt mix, we have been able to decrease the thickness of the surface course. We think this is possible because the Ramflex makes the mix tougher and more stable. For the savings in time and labor, as well as for vastly superior roads with greatly reduced maintenance, we feel that our citizens are getting the most for their tax dollar. Ramflex adds 7.2¢ to the cost of one square yard of 1½-in. thick black top surface course.

WATER SYSTEM IMPROVED TO MEET GROWING NEEDS

H. A. PACHECO,
Superintendent of Utilities,
Tombstone, Arizona

BACK in 1953, when the mayor and city council sat down with us of the utility department to map an expansion program, we set minimum specifications for new water mains and for replacement lines. We agreed on asbestos-cement pipe and Johns-Manville Transite was selected for the first installation. The pipe was scheduled for use in a project to loop existing laterals in a residential part of the town, to eliminate dead ends and to provide added capacity for a subdivision. It included a 3-in. feeder to the subdivision, a 3-in. loop line 1,790 ft. long and a 4-in. loop line 950 ft. long. The cost of the 3-in. line was $2.15 and that of the 4-in., $2.65.

By 1955, the U. S. Army's newly opened Electronic Proving Grounds at Fort Huachuca, 20 miles from Tombstone, was overloading all our utilities. This development brought on an increase in population making necessary the building of a new school and adding another subdivision. Especially hard hit was the water system. This time it wasn't going to be any 3-inch installation. What we needed was 6-inch loop nearly a mile long to take care of existing laterals and to provide expansion potential in a part of the city in which subdividers were planning new developments.

Again we sat down with the mayor and council along with a representative of the engineering firm of Headman, Ferguson and Carollo. We reviewed the extensions made since the first installation in 1953. Fire hydrant flow tests were made and we checked for pipe condition.

The 1955 project included a main loop running through the new subdivision and by the new school. It tied the east end to the west end of the system with a 6-in. line running north of the existing facilities. The cost of the 5,282 ft. of 6-in. line was $4.23 per foot.

Roy McAfee of Mesa, Arizona, won the contract and we worked closely with his men to learn any new tricks of the trade in handling the pipe. It is interesting to note that this line traversed some of the roughest terrain in the city limits. To cross some canyons we used pipe on piers as bridges above the canyon floor while in others we simply installed the pipe below the surface. In these cases we used a minimum depth of 30 inches.

This is also caliche country which spells trouble for trenching machines and for pipe layers. We provided no sand cushion in the bottom of the trench and found the excavated material contained enough fines for a covering of six inches before the trenches were back-filled with ordinary spoil. We did, however, exercise care in not dropping big rocks in the first course of fill that went into the trenches.

Since the 1955 contract job the city's water department crew has handled all installation work. They added six-inch Transite to connect the 1955 loop with a subdivision near Boothill Cemetery, which meant another project involving an arroyo, but no trouble was encountered.

CONSTRUCTION of FORT PITT TUNNEL PASSES THREE-QUARTER MARK

AT THE junction of the Ohio, Allegheny and Monongahela rivers sits the Golden Triangle, the heart of Pittsburgh, known to locals as "The Point." Crossing these three rivers are no less than 30 highway and railroad bridges.

Yet for the nearly 500,000 suburbanites living on the south banks of the Ohio and Monongahela rivers getting in and out of downtown Pittsburgh has been a twice-a-day nightmare of traffic snarls and tie-ups. The need for an artery connecting them more directly with the Point was clearly a necessity.

When it is opened, sometime during early 1961, The Fort Pitt Tunnel will fill that need and get some 40,000 motorists in and out of downtown Pittsburgh daily in record time. A tunnel under Mount Washington on the south bank of the Monongahela, and connecting with the Fort Pitt Bridge, which spans the river, is now roughly three-fourths complete. It is being built on the interstate system with the Federal government contributing 90 percent of the estimated $16 million total cost, while the State of Pennsylvania is paying the remainder.

Designed for The Pennsylvania Department of Highways by Michael Baker, Jr., Inc., Consulting Engineers, and contracted by Merritt-Chapman & Scott of N. Y., the tunnel will be composed of two parallel tubes at 60 ft. center to center, each housing two 12-ft. roadways plus a 2-ft. 9-in. sidewalk. The inside width of each tube face to face of sidewalls is 29 ft. 4 ins. The minimum thickness of the concrete lining is 1 ft. 9 ins. The northbound tube, which will be 18 ft. higher than its mate at the north end, will measure 3,437 ft. in length, while the southbound tube will be 3,432 ft. long. Clearance from the roadway to ceiling will be 14 ft.

Boring through the base of 325-ft. high Mount Washington meant blasting and mucking out 224,000 cu. yds. of rock, an operation that moved along at the rate of 16 ft. per tube per day, a total of 32 ft. per day.

In April, 1957, when tunneling began for the easterly tube, the Fort Pitt Bridge faced nothing more than a sheer cliff. For this reason, boring operations for both tubes were conducted from the south end. A jumbo was mounted on a 50-ton Mack off-highway hauler, backed into the face being worked. When drilling for one blast was completed, the jumbo pulled out. During mucking operations, the jumbo was backed into the adjacent tube, to repeat the same operation.

As boring progressed, the roof and sides of the newly cut tubes were shored by steel members consisting of 31 lb., 8-in. steel H-beams at the sides; and 40 lb., 8-in. members for the arch. These post and arch assemblies are set on 4-ft. centers, the spaces in between filled with steel channel lagging; 4,250 tons of steel supports were used in the tunnel walls and arches.

Approximately 70,000 cu. yds. of concrete form the roadway, line the sidewalls and arches, and form the 5½-in. thick ceilings.

Concrete was batched at the main plant of The Marion Coal and Supply Co. of Pittsburgh, and delivered to the site in four, high discharge, 9-yd. Jaeger mixers, plus three 7-yd. and three 6-yd. transit mixers.

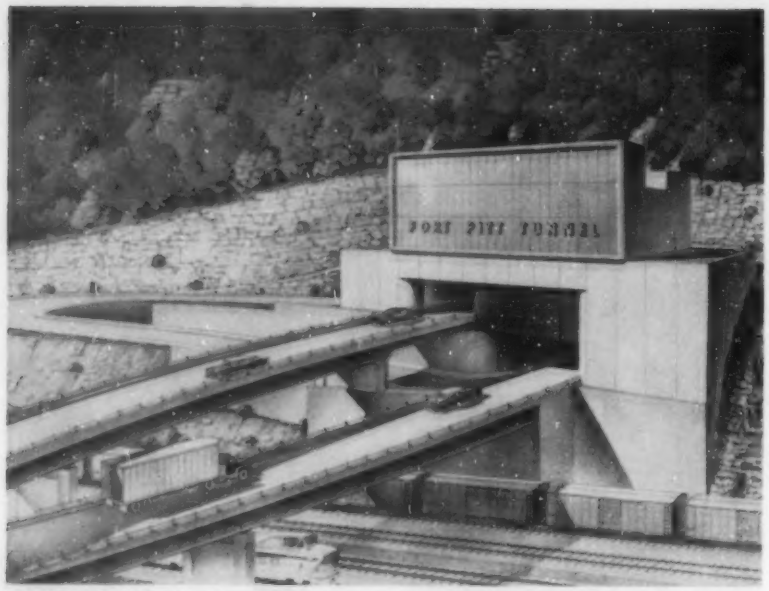
In order to produce the more than 400 cu. yds. of concrete used daily, Marion, in addition to their regular facilities, installed a complete new set of Heltzel batching, selecting and weighing equipment, which provided a double set of 4-compartment bins.

With this increased capacity, they could load two trucks within five minutes and send to the site 24 9-yd. loads, 18 7-yd. loads and 18 6-yd. loads daily within a six-hour period. If called upon, the plant can produce 600 yds. of concrete in an 8-hour day.

Because the Pennsylvania State Highway Department prohibits mixing while in transit, concrete was delivered unmixed, then mixed for three minutes at the site before pouring.

The trucks were backed into the tunnel, their loads placed on a conveyor which carried the concrete

● **FORT PITT tunnel's south portal is expected to look like this when completed some time next year. There will be two tubes, each about 2/3 mile long, 29 ft. wide.**



● **NORTH PORTAL of Fort Pitt Tunnel as visualized by artist. Northbound tube is about 18 feet higher than southbound. Tunnel is part of Interstate Highway System.**

into the hopper of a 1⅛-yd. Press-Weld pneumatic concrete placing machine. From the hopper it was shot through a riser pipe and slick line, up to 90 ft. in length into the tunnel forms.

Placing a yard every 30 seconds, workers filled one 50-ft. 4-in. long tunnel form in approximately 6 hours. Roughly 400 cu. yds. of concrete were required to fill one form. Though other work was performed around the clock, concrete was placed during daytime only.

Using three very large Blaw-Knox forms, workers poured one form per day, working on a 48-hour form stripping schedule. Once the concrete had attained a compressive strength of 1500 psi, the form was collapsed and moved on rails through the other two forms, and made ready for another pour. The required compressive strengths were easily reached in less than 48 hours.

The 5½-in. thick hung ceilings, heavily reinforced with steel bar and wire mesh, required a compressive strength of 2500 psi before stripping, a strength which was attained within 58 hours; 30 cu. yds. of the ceiling were poured at a time. In the construction of the ceiling, the decorative ceramic tile was put in place prior to concrete placement. When forms were stripped, removal of gummed paper revealed the completely tiled ceiling of the tunnel.

Low-Slump Mix

Placing concrete for tunnel linings requires special techniques involving the use of some kind of powered placing equipment. Concrete forming the sidewalls and arches of The Fort Pitt Tunnel was placed with pneumatic concrete placing equipment manufactured by The Pressed and Welded Products Co. of Pittsburgh, which called for the concrete to be forced through delivery pipes no greater than 6 in. in diameter.

The concrete mix was designed for the job by Merritt-Chapman & Scott in accordance with state highway specifications. Because placement with the pneumatic equipment requires a minimum slump of 4 in., the problem was to design a highly workable mix that would meet the strength requirements, and the State of Pennsylvania's strict water/cement ratio specifications.

Using type IA (Pennsylvania type C) air entrained Portland Cement, #2b crushed limestone, Ohio River sand (meeting Pennsylvania State class A specifications) and five gallons of water per sack of cement, the state designed mix produced a 3000-lb. concrete with a 2-in. slump. But such a thick mix could not have passed through the placing equipment without clogging the slick lines.

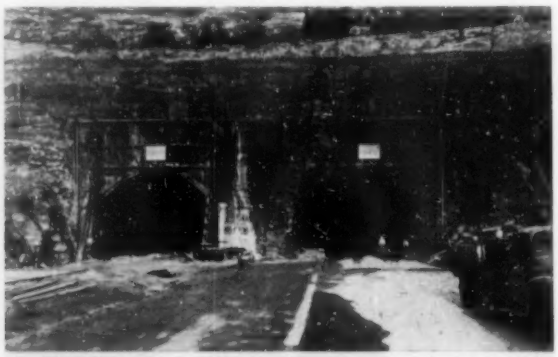
Solution to this problem came through the use of the admixture, Pozzolith, which when added to the mix produced a slump of 5½ in. without exceeding the water/cement ratio.

Selection of The Master Builders Company's Pozzolith came only after a series of exhaustive tests. Air content averaged out at 4 to 4½ percent, increasing the density of the original mix by 1 lb. per cu. ft.

In addition to increasing workability, the Pozzolith formulation used also prevented the formation of cold joints and honeycombing by retarding the early rate of hardening up to as much as 60 percent during the six-hour pour.

The ultimate specifications for the sidewalls and arches called for a highly fluid mix weighing approxi-

● **KING-SIZED forms were used for the sidewall and arch forming with work based on 48-hour form stripping schedule.**



● **TUBES enter at the same elevation at south end, but the northbound tube will be 18 ft. higher at the northern exit.**

mately 146 lbs. per cu. ft. Each cubic yard of concrete contained 587.5 lbs. of cement, 1100 lbs. of sand, 2020 lbs. of #2b crushed limestone (1¼-in. top size) and 31½ gals. of water. By heating the water and aggregate, 50° to 80° temperatures were achieved at time of placing.

Giant fans, blowing streams of water from soaker hoses were employed to cure the concrete, in accordance with state specifications.

Thorough Testing

Intensive concrete testing procedures were followed at the site. Four test cylinders were molded at every pour, cured under job conditions and broken at 2, 7 and 28 days. Each barge of sand and aggregate was tested for gradation by the Michael Baker engineers, while samples of all materials were sent daily to the Pennsylvania State Highway Testing Laboratory in Harrisburg.

Compressive strengths achieved were far in excess of the minimum specifications requirements. Typical results noted were: 2 days 2000 psi; 4 days 3400 psi; 7 days 4500 psi; 14 days 5200 psi; 21 days 5900 psi; and 28 days 6300 psi.

Actually, the Fort Pitt Tunnel represents two firsts for the Pennsylvania Department of Highways. This is the first time a consulting engineering firm has ever been retained by the Department to perform all inspection functions on a state highway job. Also it is the first time an admixture was used in the concrete to improve the workability without reducing required strengths.

Because site testing facilities could handle only concrete components, all steel, tile, pipe and some chemicals were sent to the state laboratory in Harrisburg for testing.

According to Joseph G. McCaw, resident engineer, and J. C. Bilecky, materials engineer, both of the Michael Baker firm, Pennsylvania Department of Highway requirements for the admixture performance were: 1) To increase the slump without disturbing the water/cement ratio; 2) to increase 28-day strength by 10 percent; 3) to retard setting time, and 4) to increase density.

Project Manager is James O. Irwin for Merritt-Chapman & Scott.

SAND LEAKAGE DETECTOR FOR RAPID SAND FILTERS

JOHN R. BAYLIS,

Engineer of Water Purification, Dept. of Water and Sewers, Chicago, Illinois

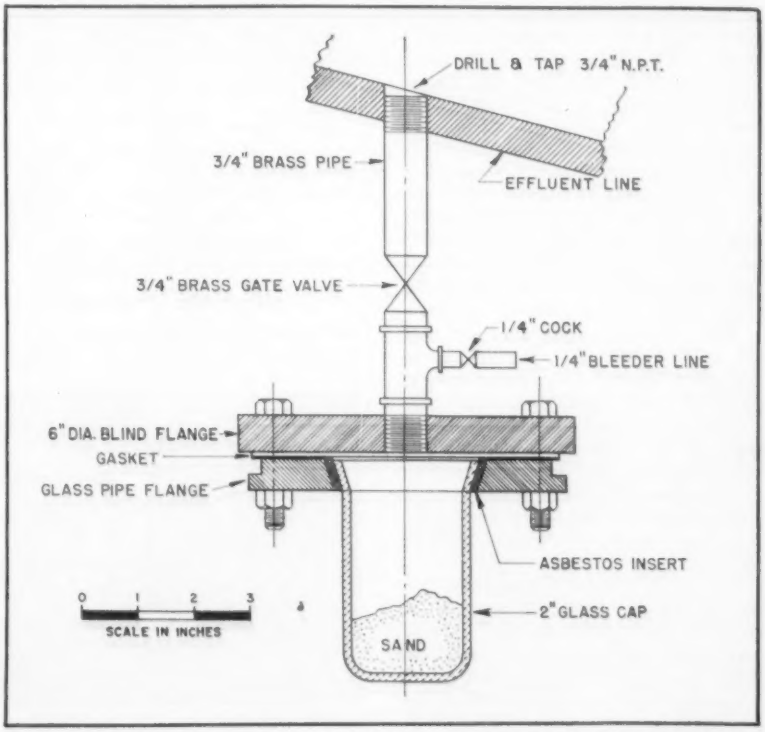
THE LEAKAGE of sand through rapid sand filters in water plants escapes notice largely by reason of the fact that there has been no good means of detecting the leakage. In many filters the quantity is so little it would be difficult to convince filter operators that sand is gradually passing through the filters. However, often the sand loss is great enough to require the addition of sand to the filters every few years. Much of the loss in many filters results from the sand being washed over the troughs in backwashing, and this causes many of us to attribute all the sand loss to such cause.

We have developed a sand leakage detector that we have tried on several filters with good success. A glass cap made for 2-inch glass piping is used, because it is a standard product procurable on the market at no great cost. Any large-mouth glass vessel that can be fastened to the bottom of the filter effluent pipe, strong enough to hold the water pressure, could be used. The volume of the inside of the vessel should be known, and the vessel should be capable of being easily removed for emptying the sand.

We used ¾-inch pipe to connect the device to the filter effluent line. One essential is that the effluent pipe be tapped on the bottom. A valve is necessary for cutting off the water when the glass vessel is to be removed.

Only a very small percentage of the sand actually passing the filter will be caught. This small amount, however, will tell that sand is passing. The rapidity with which it collects in the glass gives some indication of the rate of leakage.

On one filter installation, the receptacle had to be emptied 12 times in 11 months and on another 6 times. In some instances the receptacle was found full of sand, and there was no knowledge of how long it had been full, except as indicated by the time of the previous inspection when it was found less than full. At present, the sand leakage detectors are being examined once a week.



● **LOSS OF SAND in water filtration plants can be detected by this simple device.**

NEW RESERVOIR PROVIDES THREE-MONTH STORAGE

Courtesy Pacific Air Industries

● **RESERVOIR from the air shows layout, paving partially completed, access ramp and outlet and drain at lower left center.**

PAUL W. TRAVIS

A NEW reservoir with a capacity of 600 acre-feet of water is being completed by Newport Beach, Calif. The daily consumption has averaged 4.5 mgd. The water supply is derived in part from city-owned wells and in part from the Southern California Metropolitan Water District. Over the past few years, salt water intrusion has diminished the capacity of the wells, and very heavy use of the MWD supply by areas above Newport Beach, which is at the end of the line, brought on a water shortage.

For instance, in the mid summer of 1955, when the population of Newport Beach, a resort area, was doubled, water was lacking.

Police, fire and lifeguard vehicles roamed the streets, loud-speaking notice of the emergency and asking voluntary restrictions. Tank trucks were placed strategically for possible fires and hospitals hoarded water for emergencies.

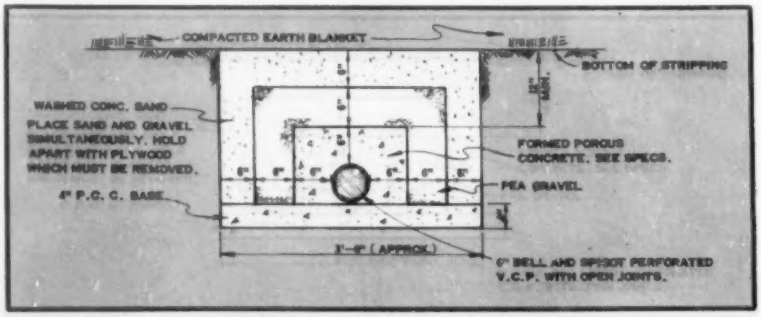
The city administration had retained Hahn, Wise and Associates, City Planners of Redwood City, and James M. Montgomery, Consulting Engineer of Pasadena, California. Consideration was given to what constitutes reasonable storage. It was pointed out, for example, that Santa Barbara had at that time 5 days' storage, but Los Angeles six months. The urgency and complexity of the problem increased when the planners estimated a probable population increase from the present 24,000 to 90,000 by the year 2000.

The upshot of this was the acceptance of the engineer's recommendation to construct a new 190,000,000-gallon reservoir, to provide a supply for more than 30 days at the existing consumption rate. The cost was estimated at $1,780,000.

Selling the Program

The selling of the program to the public was turned over to a Citizens Advisory Committee, which had been formed to plan capital improvements. Although various elected officials worked with the group, the project remained a citizen's concern.

The Advisory Committee organized a 100-member, representative-of-all, Citizens Committee for a Reservoir. To aid the promotion $5,000 was raised and on May 28, 1957, the bond issue was passed 35 to 1 (possibly a national record), with a 40 percent turnout of voters. Construction began January 7, 1958, and March 1959 saw completion, almost on schedule. William Mathis was resident engineer for the consultants, supervising the entire job.


COMPACTED EARTH BLANKET
BOTTOM OF STRIPPING
WASHED CONC. SAND
PLACE SAND AND GRAVEL SIMULTANEOUSLY. HOLD APART WITH PLYWOOD WHICH MUST BE REMOVED.
FORMED POROUS CONCRETE. SEE SPECS.
4" P.C.C. BASE
PEA GRAVEL
1'-9" (APPROX.)
6" BELL AND SPIGOT PERFORATED V.C.P. WITH OPEN JOINTS.

● **TO PREVENT seepage from underground drainage channels building up under embankment (foreground in picture above) subsurface drainage was provided.**

Superior Location

The reservoir was built on a narrow, V-type canyon, where the natural terrain makes an efficient site for the 40-ft. deep, 15-acre-surface, reservoir. Through good planning only 100,000 out of 740,000 cubic yards of earth moved had to be taken away; the remainder was used for the embankments. Fortunately, the predominating earth was Monterey shale which made a most satisfactory base for the reservoir. The chief difficulty in earth removal was caused by large rocks 3 to 8 ft. in diameter. These had to be carted away, for they could not be placed in the embankments.

The site was also efficient from the standpoint of gravity flow. By it MWD water comes into the reservoir through a 48-inch inlet line. The 54-inch outlet pipe has 15 psi pressure, with 80 lbs. at the first takeoff, 2 miles below. Moreover, the site is high enough to provide a pressure supply to the likely areas of expansion in the future. Two extra 30-inch outlets, now blanked out, can be used to deliver water to areas above gravity pressure should the city expand to beyond present expectations.

Excavation

J. E. Riley and Son, Anaheim, California, earthwork contractors, began by stripping in the canyon's channel, then moving to the canyon sides. Thus it was possible for the general contractors, Montgomery Ross Fischer, Inc., of West Los Angeles, to start work on the unique underdrains described in the next section.

The contract called for stripping five feet below the natural ground on the finished reservoir's interior. This stripping was to guarantee a foundation of at least five feet of the Monterey shale.

There was no dependence on log borings in the pricing of the excavation contract. Instead, the contractor was paid a stipulated price for each cubic yard of earth removed. It was specified he was to clean out all sand pockets and any other material that might weaken the reservoir lining's foundation. Large sand deposits were removed from along the canyon's edges—one pocket had a depth of 18 ft.

Excavating equipment used included five tractors and dozers, two motor graders, seven self-propelled pneumatic scrapers, two sheepsfoot tampers and one 50-ton pneumatic roller.

The Monterey shale was tamped down with several passes of a sheepsfoot, maintaining moisture for optimum compaction.

In 12 months 16 pieces of heavy equipment and twenty men moved 750,000 cubic yards of earth—up to 8700 a day.

The embankment sections have slopes of 3 on 1 both inside and out. A 20-ft. wide paved road, with a concrete curb on the inner side tops the embankment and a 20-ft. road leads down the east bank to the bottom.

Drainage and Underdrainage

The drainage from the natural canyon above the reservoir had to be disposed of. To care for this, 8-ft. wide ditches were dug around both sides of the reservoir. These carry the drainage out into the spillage ditch in the canyon below.

There was also danger of underground drainage and of reservoir seepage building up pressure under the west embankment of the reservoir. To provide for this, a drainage system was built beneath the embankment where it covered the channel of the former canyon.

This system consists of a main running along the canyon's old channel, with a north and two south laterals—the entire system totaling 1000 ft. in length. These drains were constructed as follows: First a trench was cut below the bottom of the reservoir level. In this was poured a 4-inch slab of concrete. On top of this was placed a 6-inch perforated clay pipe, with open joints, encased in a porous concrete mixture of pea gravel and cement. This was covered with a 6-inch layer of pea gravel, and then 6 ins. of sand were placed to filter the inflowing water. Finally, the embankment material was tamped in above to complete the filling of the trench.

Concrete cutoff walls were constructed at right angles to the drain pipes to direct the water, which might be flowing alongside the filter, into the drains. The upper ends of the drains were capped with a concrete wall.

It is interesting to note that this system seeped throughout the 3 or 4-month rainy season last year—at times as much as 5 gals. a minute. There has been no drainage so far this past winter which was an exceedingly dry one in Southern California.

● **RESERVOIR was paved with a 3-inch thick asphaltic concrete surface. On slopes, truck was winched down and discharged through a box to Barber-Greene paver.**

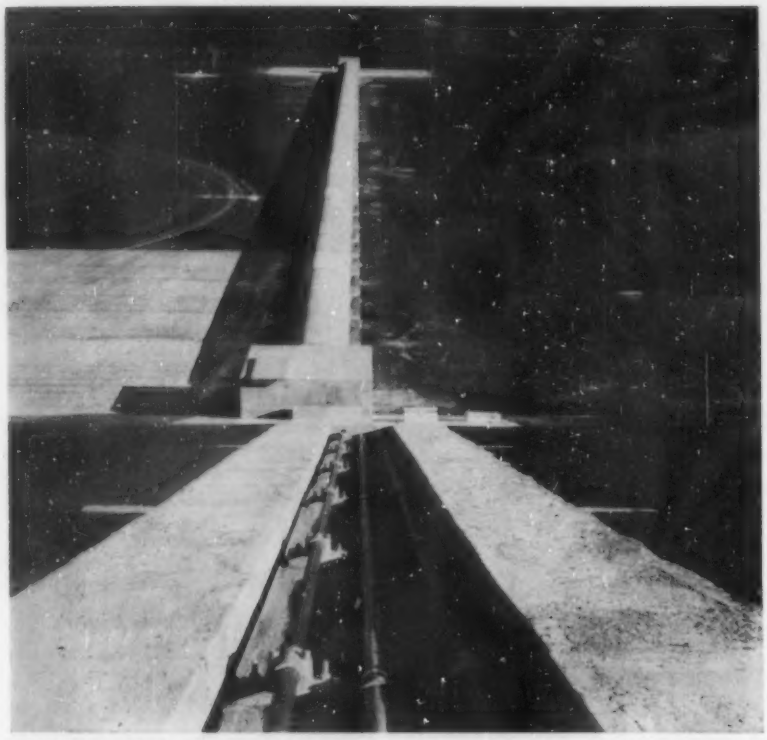
The contractor reports that several times the unfinished work on these drains was washed out by water coming down the canyon representing the chief construction problem he had on this particular job.

The Reservoir

The 500,000 sq. ft. of the 3-to-1 sloping walls and the 500,000 sq. ft. of the reservoir's bottom were treated with Borascu, a patented weed killer made of borax powder, manufactured by Henderson Spray Chemical Company, Los Angeles, California.

A 3-inch asphaltic-concrete surface was laid directly over the earth. This was constructed with ¾-inch to No. 4 gravel, proportioned to produce voids and thus a pervious lining which would permit some upflow with the reservoir empty.

R. J. Noble Company, paving contractors of Orange, California, laid the floor with a Barber-Greene



● **OUTLET PIPE in background is shown as it reaches to the center of the reservoir (extreme background). Inlet-outlet tunnel connection in center. In foreground, left is inlet valve control; center is chlorine feed; right is outlet valve control.**

paver. On the slopes, a truck carrying paving material was winched up and down with crawler tractors and rollers. Attached behind was a spreader box, the same width as the truck and two feet long. By gravity the paving material flowed out of the truck and through the spreader box. Proper thickness was obtained by adjusting a plate or screed over which the material flowed.

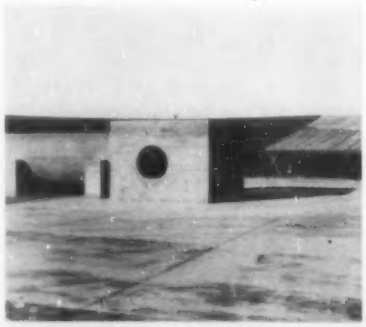
Outside embankments, also 3-to-1 slopes were laid over with a foot of the original top soil which was piled around the base of the exterior during construction, and then pushed up. Two inches of straw were worked in with 4-inch wide, plate type sheepsfoot and a blade on a circular drum. The outer slopes of the embankment will be left as they are with only the grass that will grow out of the original top soil. All paving was rolled normally.

Piping

The pipes, along with a 12-in. drain line, enter the reservoir through an inlet-outlet tunnel, 16 ft. wide and 8 ft. deep, running from the control house on the reservoir bottom through to the outside of the embankment. The drain line can be used to carry off rinsing water from the reservoir and the control house, 28 ft. above.

M. R. Fischer's job superintendent, Jean Cacan, reported much frustration in putting in the tunnel in the rainy season. Forms were washed out or filled up frequently with water coming down the canyon.

The finished tunnel has concrete floors and walls up to the spring line. The tunnel cover is half-round, corrugated Armco culverting, covered with concrete and then earth fill. Open space between pipes and tunnel walls insures no weight on the pipes. The plastic waterstops at the joints of the tunnel are of the six-inch Neoprene Dura jointing, made by the Tecon Products Company.



● **OUTLET chamber in center of reservoir has openings on three sides. Outlet pipe, see picture above, is at left.**

Operating Plans

Robert Shelton, City Manager, says the city plans conventional chlorination. An automatic chlorine controller, supplied by Wallace and Tiernan can be preset to deliver the desired dosage and to maintain this dosage regardless of the amount of water flow.

A full-time operator will also be the arborator for the park department's tree farm—to be located just east of the reservoir.

Though the city is rightfully proud of the new reservoir, the administration is now turning to a problem bothering farsighted city officials throughout Southern California—a source for sufficient water. Newport can now get MWD water when demand is low and store it for high consumption times. But, if Los Angeles' demand grows and it takes its full entitlement, and it has priority over Newport, Newport would be in a serious situation. Therefore, Newport is seeking other sources, maybe wells upstream in the dry bed of nearby Santa Ana river; or conversion of salt water into fresh.

• • •

Dutch Elm Disease

During the year of 1958, Oakland County, Mich., removed a total of 549 elm trees which were either infected with Dutch elm disease or were condemned as being breeding places for the beetles, which are the carriers. This is an increase of 291 trees, or 112 percent over the number of trees removed in 1957.

Due to the disposal problem and because this wood has to be destroyed by burning, the average cost of removal is $100 per tree. This cost includes the removal, hauling and burning of the wood at the disposal sites.

Sanitary Landfills and Incinerators in New Jersey

Earlier this year, according to the New Jersey State Department of Health, there were 77 operating sanitary landfills in New Jersey serving the disposal needs of 234 municipalities. These 234 municipalities constitute 38 percent of New Jersey's population. In addition, there were 18 municipalities, representing 15 percent of New Jersey's population, which were using incinerators for garbage and refuse disposal. Sanitary landfills and incinerators together are taking care of the disposal needs of 53 percent of New Jersey's population.

HOW A COUNTY SOLVES ITS SEWAGE DISPOSAL PROBLEMS

WILLIAM F. PILLSBURY,
Utilities Division Engineer,
Department of Public Works,
Sacramento County, California

BY THE year 1972, the population of Sacramento County, now 490,000, is expected to exceed 900,000. The increase in population was 133 percent in the last 13 years and the projected increase is 84 percent in the next 13 years. From the past growth pattern and the projected increase of population it does not tax the imagination to visualize the problems of sewage disposal that have confronted the Department of Public Works and in particular the Utilities Division of that Department, which has the responsibility of planning, providing and maintaining the public sewage disposal facilities in the major portion of the unincorporated area of the County.

Further to complicate the problem of sewage disposal, a large part of the County in which rapid development has taken place has soil conditions which make disposal of wastes by use of septic tanks and leaching facilities completely impractical. Most of the area has dense soil conditions or hardpan to depths extending to the first water bearing strata. Several large areas have a perched water table within 10 feet of the ground surface which makes the use of leaching systems unsatisfactory.

Problems of Sewage Disposal

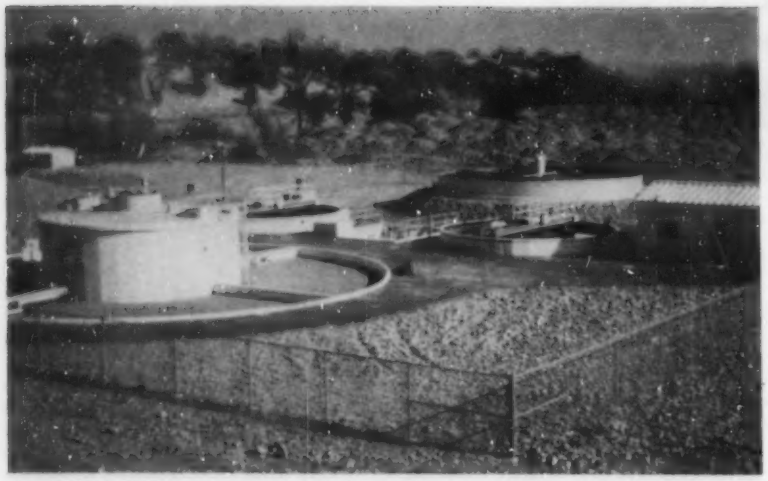
The rapid growth of the metropolitan area adjacent to the City of Sacramento, together with the leapfrog pattern of the related subdivision developments has caused problems in financing and constructing the most economical sewage disposal facilities. Still another problem is the lack of nearby streams which provide adequate dilution ratios for receiving treated effluents from sewage treatment plant works. Much of the area in the County has only minor local water courses which are normally dry during the summer months. Consequently, these water courses have pollutional requirements of the highest criterion, which makes the construction and operation costs of sewage treatment plants relatively high.

The construction of County operated and maintained sewage collection and disposal facilities was started in 1946. In the short period of time that has elapsed since this first construction, over 440 miles of trunk and lateral sewer systems, 11 sewage treatment plants, and 33 sewage lift or pumping stations have been constructed and are now under the jurisdiction of the Utilities Division of the Department of Public Works. All of these sewage works are contained within five active Sanitation Districts and 12 Sewer Maintenance Districts.

Financing the construction of major trunk lines and treatment plants is a complex problem. It is usually desirable to construct fewer and larger treatment plants and trunk lines large enough to serve the ultimate flow from as large a tributary area as possible. However, this puts

● **THIS IS sewage treatment plant No. 3 which was designed for an ultimate population of 64,000. Main control house and central laboratory are in the background.**

● **INTERIOR of the main control house, shown in the background above; this illustrates the central laboratory facilities which have been provided for plant control.**



● **ARDEN GOLD treatment plant is designed for a population of 4,000 and consists of sedimentation followed by a trickling filter. This is one of 11 treatment plants.**

the County in the position of providing facilities to serve future developments, and places the burden of paying the bond interest, redemption and operational costs on the initial few. In many instances, this makes the construction program completely unfeasible. As mentioned previously, the pattern of subdivision development has been primarily of a scattered nature, leaving large parcels of relatively low density population in between small areas of dense population. This has resulted in valuations too low to support major bond issues for constructing sewage facilities to serve an over-all area, which would of course be the most economical procedure.

In order to raise funds to construct, operate and maintain these facilities, it has been necessary to create County Sanitation Districts or County Sewer Maintenance Districts. A sanitation district is formed in unsewered areas in which the residents have requested sewage collection and disposal facilities. The maintenance and operation of the facilities is also done by the sanitation district. The maintenance districts are formed strictly for the purpose of raising revenue to maintain and operate facilities after they have been financed and constructed by other means. This type of District has been used where subdivision developers have financed and constructed the collection and disposal system for purposes of serving new tracts or subdivision developments. In practically all cases the County Board of Supervisors serves as the Board of Directors for a sanitation or sewer maintenance district.

One of the first problems that had to be overcome in order to provide public sewage disposal systems was to organize and build an organization to administer, operate and maintain these facilities. Starting in 1946 when the first County Sanitation District was formed, the County Engineer was appointed by the Board of Supervisors to act as the District Engineer and six members of his staff were designated to do the initial field surveys, engineering, legal proceedings and other pertinent work necessary to accomplish the initial construction of the trunk lines, lateral sewers and pump stations.

As the growth of the County continued, it was necessary to expand the staff of the County Engineer in order to keep pace with the continually increasing demands for public works functions. Three years ago, the office of the County Engineer was reorganized and as a result A. L. Kiefer, the County Engineer, became the Director of Public Works for the newly created Department of Public Works. This department now has five Divisions, including the Utilities Division with 123 employees.

Utilities Division

The Utilities Division has the responsibility of providing the general administration, design and construction, and maintenance and operation of all the facilities for the County Sanitation Districts and Sewer Maintenance Districts, as well as Maintenance Districts, Street Lighting Districts, portions of the Storm Drainage Districts and other miscellaneous utility functions.

In addition to the five active County Sanitation Districts and 12 Sewer Maintenance Districts, there are 11 Water Maintenance Districts, 13 Lighting Districts and seven Storm Drainage Districts, or a total of 48 districts under the jurisdiction of this Division.

The services of the personnel in the Division are used by all the districts and their time is prorated in accordance with the amount of hours worked on the facilities in each district. The same applies to the equipment that is used by the Division. It is purchased by all of the districts and the cost thereof prorated to each according to its annual expenditures. In addition, using the same personnel for all of these districts, provides a great deal of flexibility. If an emergency prob-

● **MANLOVE sewage treatment plant is a small one. It was designed to provide complete treatment for a population of 1,500 utilizing a junior size high rate filter.**

lem occurs in one district one or more maintenance crews can be immediately dispatched to the spot in a matter of minutes by use of the two-way radio system operated by the Department of Public Works. This service is provided on a 24-hour basis, seven days a week.

The type of central control that the County of Sacramento maintains over all the special districts under the Board of Supervisors, through the Utilities Division of the Department of Public Works, provides an extremely efficient and economical type of administration. There is no costly duplication of administration, equipment, personnel, or other items that would occur if each district was controlled by a separate entity.

Another step which was taken to solve this County's sewage disposal problems was to require developers to construct sewage treatment works and trunk lines large enough to serve the ultimate population of their subdivision development. Originally, it was a County requirement that these developments be for not less than 1,500 people or 400 homes. This has since been increased to require subdivision developments to construct a treatment plant and trunk lines to serve not less than 10,000 persons or approximately 2,700 homes unless the area and conditions are definitely such as to indicate a lesser design. This requirement has had a tendency to consolidate the subdivision developments into more logical growth patterns, thus cutting down on the leapfrog pattern of development.

Construction of these relatively small sewage treatment plants has provided a means of permitting development and expansion of the County to continue at a rapid pace. As the development continues, the assessed valuation increases along with it. When this program of sewage disposal was embarked upon, it was contemplated that many of these small plants would serve only on an interim basis until the development and assessed valuation increased to a point where they could support a bond issue for purposes of constructing an over-all integrated sewage collection and disposal system.

The 11 treatment plants that are in operation vary considerably in design capacity. The smallest plant is designed to treat the sewage flow from 1,500 persons at an average daily flow of 100 gals. per capita. The largest plant is designed for 64,000 persons and the combined design population of all plants amounts to approximately 200,000. Capacity of the existing plants could be increased to 320,000 by nominal additions or expansions. Provisions have been included in the initial design of many of the plants to permit economical expansion.

● **PARKWAY ESTATES treatment plant was designed for a population of 12,500. It uses both activated sludge and high rate filtration; final effluent is chlorinated.**

In constructing these plants, almost every type of treatment process used today in modern sewage treatment practice has been employed. There is one plant which provides only primary treatment. This plant discharges directly to the Sacramento River where there is considerable dilution. The other 10 plants provide complete or secondary type treatment. Several of the plants provide activated sludge treatment and others high rate filtration or biofiltration treatment. One plant has a combination of the two types of treatment. Two plants are required to produce effluents of such high quality that a final polishing stage of treatment is necessary before discharge of the effluent. In one of these plants, chemical coagulation and precipitation is used in conjunction with chlorination. Alum is used for the coagulation agent. The other plant uses sand filters prior to final chlorination. In both instances, the results have been highly satisfactory. The variation in the treatment processes is due to the different discharge requirements that are established by the State Water Pollution Control Board. These discharge requirements vary somewhat due to different size, condition and uses of the stream into which the treated effluent from each plant is discharged.

The number of treatment plants and variation in treatment processes, as well as the diversified services offered by the Utilities Division, requires careful consideration in the staffing and organization of the Division.

It is essential that the operating personnel be very versatile and flexible in order to keep pace with the different types of treatment processes and the problems peculiar to each individual plant. In order to acquaint the operating personnel with each plant, personnel are rotated from plant to plant at periodic intervals. This rotation is particularly applicable to new personnel, and by the time an operator has advanced to a position of responsible charge, he is familiar with the County's plants and rotation is not required. Through this in-service training, personnel familiar with a given plant are available in case of emergency or in making vacation replacements.

The laboratory control program for the operation of all the County plants is done at a central laboratory located at the Sanitation District No. 3 Plant. Also provided at this plant is space for the installation of telemetering equipment which it is planned to install in the near future. By using telemetering equipment, critical pumps, chlorinators and other essential equipment at other outlying plants can be monitored on a 24-hour basis. In this way, it will be possible to eliminate the cost of personnel that would otherwise be required for safety purposes only.

Financing Methods

Financing the cost of constructing the sewage treatment plants and trunk lines has been handled in

● **CHEMICAL feeder applying alum for final stage treatment of Manxanita.**

three different ways. In the case of the sanitation districts, general obligation bonds have been sold after first receiving a two thirds favorable vote of the registered voters within the District. The works constructed within the sanitation districts are generally quite large and serve primarily areas which have developed on septic tanks but now need public sewers before growth of the area can continue.

The second and most extensively used method of financing is by creating a sewer assessment district under the direction and authority of the County Board of Supervisors. Through these special assessment proceedings, the individual developer or group of developers sells bonds sufficient to pay for his pro-rata share of the treatment plant and trunk system.

The third method, and the one which has been used the least, is for an individual developer or group of developers to arrange his own financing, award his own contracts for construction, and construct the plant and system under the inspection and approval of the Utilities Division.

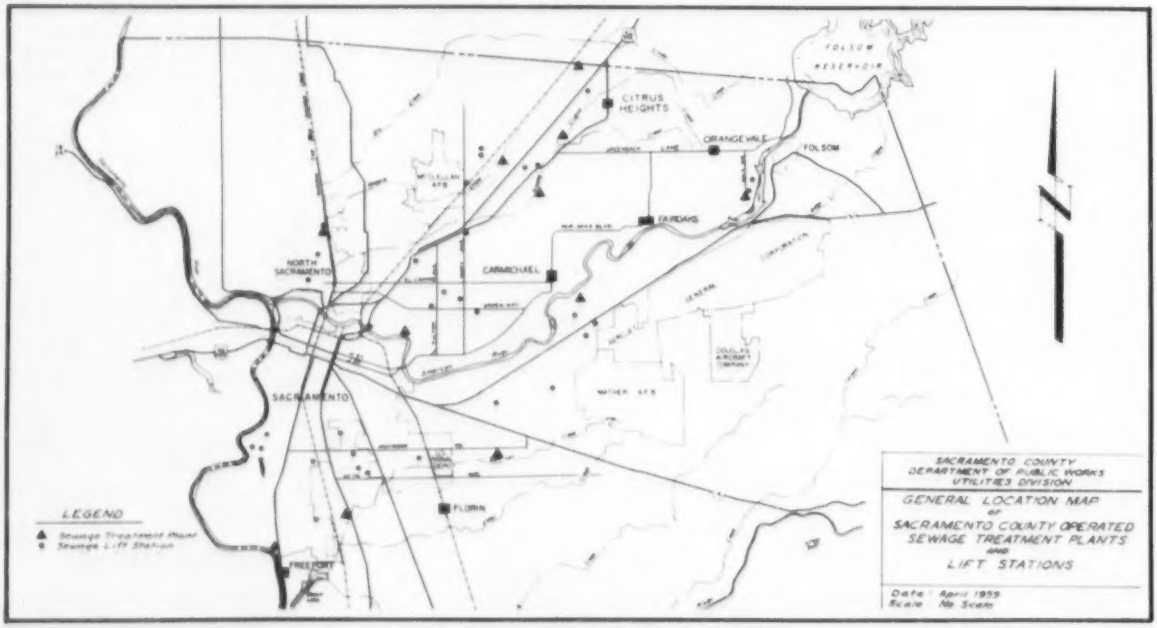
When the construction has been completed in the latter two cases, a Sewer Maintenance District is formed to raise revenue by taxation to pay for the annual maintenance and operation costs.

In the preceding paragraphs, some of the sewage disposal problems in a rapidly growing county area have been outlined and the means used to overcome them discussed. Most of the discussion has centered around the solving of this problem by using small treatment plants during the stage of development where it is impractical to provide sewerage systems to serve a large over-all area. However, some areas of Sacramento County are now reaching a stage of development where it is feasible to vote a large bond issue for the purpose of constructing an integrated sewage collection system and one point of treatment disposal in order to effect an over-all economy.

Realizing that this stage of development was approaching, the Board of Supervisors of Sacramento County authorized an over-all County-Wide Sewage Study and Report in May, 1958. This study is currently being made by the firm of Dewante and Stowell, Consulting Sanitary and Civil Engineers, and will be finished in 1959.

A portion of this study has been completed and a recommendation was submitted to proceed with the formation of a County Sanitation District to serve the entire 60 square mile area of the north east portion of the County. This plan will combine three existing Sewer Maintenance Districts and four small Sanitation Districts. A system of trunk sewers will be designed to serve the ultimate projected population of 370,000 people in this area. The treatment plant will be built in stages, as the population of the district increases, with the initial stage being constructed to serve a population of 90,000 people.

It is expected that the County-Wide Study and Report will provide considerable assistance in controlling and directing the future development of sewerage facilities in the County. Master plans will be established for major areas now rapidly changing from a rural to urban character and added criteria will be available to enable interim developments to proceed on a logical basis. It is the primary objective of the Utilities Division to direct the installation of sewerage facilities in accordance with such sound principles so that sewage service can be provided to the people of the County in the most economical manner.



● **MAP SHOWS locations of the 11 sewage treatment plants now in operation. These vary considerably in design capacity.**

● **ABOVE:** Maintenance supervisor is discussing problem with a foreman. Supervisory personnel can communicate with crews and office.

● **LEFT:** Field office dispatcher has just received report of pavement break and is contacting maintenance crew located near job to be done.

IMPROVED COMMUNICATIONS PRODUCE BETTER HIGHWAY MAINTENANCE

PHIL HIRSCH

TWO-WAY RADIO is enabling the Cook County, Illinois, Highway Department to improve the efficiency of its secondary road maintenance operations substantially. Maintenance Engineer Thomas McHugh says:

"Radio permits us to maintain constant communication with the bulk of our field forces at all times, no matter where they may be. If a truck gets stuck, or breaks down; if additional equipment or materials are needed to finish a job; or if a service call comes in from a resident of the county after our maintenance crews have been dispatched, we can handle the problem in a minimum amount of time."

Supervisory personnel are no longer unavailable whenever they leave their desks. With radio, they are still able to help their foremen cope with any of the myriad problems that can arise on the job. It is no longer necessary to route telephone messages through one or more persons at the district office. Questions get answered in far less time, and the chances of the message getting garbled in transit are reduced to a minimum.

The division of secondary roads has been using two-way radio since May, 1957. Essentially, the system consists of six base stations and 60 mobile units. One base station is located at each of the five field offices of the division. A warehouse, containing supplies and spare parts, plus a garage, is attached to each office. The sixth base station is located atop the Cook County Highway Department building in the Loop. A transceiver in the office of Mr. McHugh is connected to this unit.

Of the 60 mobile transceivers, 13 are installed in passenger cars assigned to division engineers and supervisors; 8 more mobile units are mounted inside Walters Snowfighters; 6 personnel carriers—International Harvester Metro trucks which transport labor gangs from job to job—also are radio-equipped. The remaining 33 units are installed in 2½ and 3½-ton capacity dump trucks assigned to two-man road patrols which handle routine maintenance chores and are available for emergency duty.

These forces are responsible for some 650 miles of secondary roads, surfaced with bituminous material and crushed stone for the most part, which are within a semicircular belt extending around the northern, western, and southern corporate limits of Chicago.

The two-way radio installation has proven particularly valuable during the winter snow-fighting season, reports Mr. McHugh. "Often our crews are working late at night, miles from the nearest phone. If, as sometimes happens, a truck runs off the road and loses traction, or if it has a breakdown, we can get the vehicle back on the job with a minimum amount of delay. Frequently, another truck in the vicinity can be dispatched to get the first one into service again. In the case of mechanical trouble, the driver can radio the district office and have a mechanic on his way in a few minutes."

Before radio was installed, a snowplow crew that became stuck in the field often remained that way for quite a while. Usually one man took off in the snow and cold to hunt up a phone, while the other

one stayed with the equipment. Sometimes the first man was able to find a phone quickly and alert the field office. At other times, a supervisor on an inspection trip would find the cripple. The supervisor then had to travel back to the field office, or to a nearby crew, and obtain the necessary assistance. In the bulk of the cases it took at least an hour, and usually longer, for the crew manning the stalled equipment to get word to someone capable of providing help. Now, thanks to radio, this delay is eliminated almost completely.

Mobile communications provide a somewhat similar advantage for the 10-man crews the county uses for general highway repair work. The crews devote a good percentage of their working time to answering service calls which come in from motorists and homeowners. Frequently the callers do not describe the job very completely. They report that "the pavement is cracked," or that "there is water on the road," but can't indicate the source or extent of the trouble. When the crew answers the call, although it comes well-prepared, additional supplies or equipment are sometimes required.

Recently, for example, after a heavy rainstorm a homeowner called to report that the road in front of his residence, as well as a large area on either side of the pavement, was covered with water. When the crew arrived, they discovered that the drain tile was plugged. After removing the obstruction the excess water was soon disposed of, but then it was found that a large section of the homeowner's driveway had washed away. To repair this damage the crew needed a load of crushed stone. Using his radio, the foreman ordered this material from the field office warehouse. Within half an hour it had arrived and the men were at work.

There are important public relations benefits, too. Often the crew shows up less than an hour after a homeowner has reported an obstructed culvert, cracked pavement, or some similar problem. "Our prompt service seldom goes unnoticed," reports Mr. McHugh. "A number of county residents have called, or written in, to compliment us on our efficiency."

Under the previous procedure, he adds, each crew reported in to the field office once a day by phone. "Whenever we had emergency repairs—flooded pavements, or broken bridge railings, for example—the job had to be assigned to the crew that called the office first. This crew frequently was miles away from the job-site when another gang was much closer. But because we couldn't reach the latter crew immediately, and couldn't be sure of when it would call in, we had to employ an inefficient assignment procedure."

Among the most important benefits of a two-way radio system, explains one of the county's highway maintenance supervisors, is that "it allows us to control our operations much better." If crews run into unforeseen difficulties, that prevent them from meeting a given work schedule, some of their jobs can be shifted to other forces. Also, new jobs that come in during the day can be assigned to those crews with the lowest work backlog. Previously, attempting to distribute the load evenly was difficult because of the problem of getting in touch with a particular foreman.

Installation cost of Cook County's two-way radio system, which was manufactured by Motorola, totalled $120,000. Maintenance, supplied under contract by the same firm, adds $10,000 a year to this figure.

"When you amortize these costs over a 10-year period," explains Mr. McHugh, "they come to less than $65 a day. We are convinced that the system is saving us far more than that by making it possible to utilize our trucks and work forces more efficiently, by reducing the time involved in handling service calls, and by enabling supervisory personnel to maintain much tighter control over on-the-job operations."

Widener Speeds Road Rehabilitation

AGGREGATE is being placed at a rate of 2,500 cubic yards per day—and at a cost of only 10 cents per yard—by A. E. Burgess Company, Birmingham, Ala., on a road rehabilitation job from Birmingham north to the Tennessee state line. The project calls for construction of eight miles of U. S. Route 31 to Interstate Route 65.

The aggregate placing system utilizes a fast discharging road widener, a Blaw-Knox Model 95, feeding from 20-cubic-yard trucks. A total of 250,000 cubic yards of aggregate is being employed for the 10-foot wide outside shoulders and each of the 6-foot wide inside shoulders. Both shoulders include compacted layers of 3-inch thick No. 6 stone, 6-inch thick local sandstone, 4½-inch thick local sandstone and a 4-inch thick mixture of No. 5 and 7 stone.

The road widener moves on existing pavement with the spreader attachment off the road shoulder. A 20-cubic-yard truck is pushed by the widener, which is powered with a Continental F-226 engine and equipped with tandem drive wheels. Aggregate is charged onto a 24-inch wide conveyor belt, spaced on 9-inch centers, and then discharged at the same rate into the shoulder where the widener's strike-off gate produces a sweeping - scraping action.

● **ROAD WIDENER on Interstate Route 65 gets aggregate from a 20-yard truck**

DYNAMITE + IMAGINATION and EXPERIENCE = ECONOMY

WILLIAM F. HALLSTEAD

SINCE ITS development in 1866, dynamite has become a standard and essential tool of construction. But though it has been in use for almost a century, improvements in blasting techniques and the discovery of new applications continue to increase its importance. Through imaginative and skilled application of explosives, the blasting specialist can save time, money, even lives, in municipal, industrial and utility work; for anyone, in fact, engaged in activities where blasting techniques are applicable.

The more imaginative and flexible an experienced explosives expert is, the greater his value. He will get maximum results from minimum loadings, develop tighter control of vibration, concussion and debris, and in many instances will develop applications new to the field.

As an example of such a progressive explosives contractor, the author has selected John D. Loizeaux, president of Burnbrae, Inc., a dynamiting specialist with over 12 years of experience. Burnbrae, in Towson, Maryland, has handled standard dynamiting work ranging from highway construction to major building demolition, and has tackled such unusual blasting applications as the removal of warped industrial furnace floors and the enlargement of duct bank openings in a busily operating shipyard.

Even in such an apparently standardized operation as rock removal for highway construction, Burnbrae has devised techniques that are often overlooked by part-time blasters or by contractors engaged in blasting as only a part of their overall concern.

"One of our basic ideas," says Loizeaux, "is to make rock shots as large as possible. Instead of firing a series of small shots, we would rather drill and load all day, then do the actual shooting in just a few big firings after the rest of the job has closed down for the day. This holds down disruption of the other work, makes the shooting a safer operation, cuts labor costs all around, and eliminates the rock 'ribs' that often are created by a series of small rock shots."

Blasting Machines

One reason many contractors engage in a series of time-consuming small shots instead of shooting large areas of rock at one time is their use of out-dated blasting equipment. The familiar push down blasting machine, for example, will fire only 50 caps routinely and a maximum of 200 caps under special circumstances. The advanced blasting specialist will employ a condenser discharge blasting machine such as the Du Pont CD-48-1 which will fire 1,200 caps at a time.

How are the concussion and vibration of such a large firing controlled? Through the use of millisecond (MS) delay caps, Burnbrae is able to excavate rock in quantity even in confined areas. For example, one job involved excavating rock for the widening of a street in a residential area well within city limits. Though some 1,000 cu. yd. of rock were excavated by blasting, there was no excessive vibration or concussion. In fact, not one complaint was received from nearby residents.

"We send our own representative door to door in a situation like that," Loizeaux explains. "He outlines exactly what we're going to do and the steps we take to prevent any property damage. That, plus the use of delay caps, lets us work in places where an inexperienced man would throw up his hands."

All of Burnbrae's work involves the use of MS and standard delay caps. Thus only a very few sticks of dynamite detonate at any given instant. This spreads concussion thin instead of producing a concentrated wallop. Rock shattering effect is often improved as the force is applied in precisely timed and spaced increments.

Something that appalls Loizeaux as a professional dynamiter is the careless handling of explosives. "It happens much too often," he says. "I've seen general contractors hauling dynamite and caps down rough roads at high speed in stake body trucks. No wonder children find caps lying around. If a man is going to handle explosives, he's got to use specialized equipment — trucks designed to carry explosives, high capacity detonating machines and the right explosives for each job."

Loizeaux further contends that some contractors do not value the use of explosives enough to hire a full-time powder man, or even to ask for advice from dynamite manufacturers. There is a considerable amount of "drifting" among blasting personnel. Burnbrae has adopted the policy of carrying reliable powder men on the payroll through slack periods, thus retaining their hard-to-replace experience.

In Loizeaux's opinion, a good

● **BLAST has been exploded and stack is beginning to fall. Only 6½ pounds of dynamite were required. Pictures on opposite page show final stages in demolition.**

many highway and other heavy construction contractors completely overlook the value of explosives in routine operations. "We have often been able to drill and shoot rock for only $1 a yard," he says. "Yet I've seen contractors fight that same kind of rock with dozers, scrapers, and other kinds of equipment when 'equipment removal' was wrong costwise and timewise."

Building Demolition

One of Burnbrae's most dramatic applications of explosives is in the field of building demolition. Through the use of MS and standard delay caps, the firm has devised a system of safely razing buildings in built-up areas.

The secret of Loizeaux's precision in all demolition work is the placement of small charges at key locations. When these primary underpinnings are cut, the structure's own weight does the major part of the work. Charges are placed only in basement columns and basement wall columns. Delays are timed so that the building collapses in upon itself or falls away from nearby obstacles.

Three apartment buildings, eight stories high, in Washington, D.C., are examples of structures razed by Burnbrae. The first apartment to go was supported in the basement by 38 columns. The dynamiting contractor drilled each column with six 1½-inch blast holes and loaded each hole with less than half a pound of 40 percent Du Pont Special Gelatin. Regular delay caps — one second through ten seconds—were used in 27 of the columns. The rest of the columns were capped with instantaneous caps and MS delays. These were used along the west wall of the basement to pull the structure away from the adjacent building to the east.

Precisely as planned, the west side of the building began to crumble as the instant and MS capped charges went off. The firing spread eastward through the basement as the delays detonated at 1-second intervals. The building collapsed as anticipated—inwards upon itself and slightly to the west away from the adjacent building.

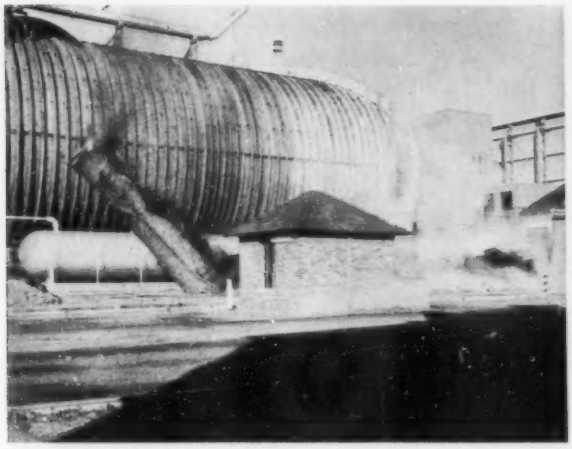
The second structure was loaded differently. The 87 basement columns were drilled with four blast holes each. This structure was intended to fall inwards upon itself with the point of initial collapse off-center to pull the south and east walls to the northwest away from the sidewalks. MS-25 to MS-100 charges were placed in a group of columns in the northwest portion of the basement. The regular delay charges were planted in concentric groups around the MS-capped charges so the firing would fan outward from the desired center of collapse, reaching the sidewalk-fronting walls last.

Charges were placed in the basement columns of the third structure —a U-shaped building—so that it would collapse inward from the sidewalk and to the northwest. The 17-second firing sequence began with a heavy instantaneous charge in a crawl space to the west plus an MS group on the first floor of the west wing. These, incidentally, were the only charges placed above ground level, and it was done by necessity because the crawl space made drilling practically impossible except for the one heavy instantaneous charge. All west wing first floor windows were tightly timbered, and there was no escape of debris. After the initial firing under the west portion of the building, the successive delays "walked" eastward.

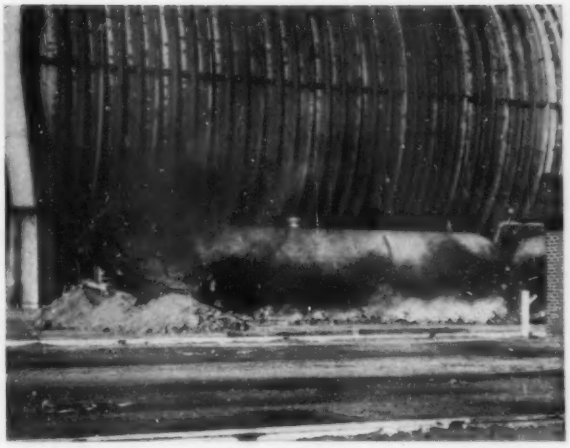
The city had condemned all the trees and street lights along the streets adjacent to the buildings. Not a tree or light was touched. There was not one case of cracked glass or any damage to underground utilities. Because Burnbrae had spread the effect of quite heavy charges over 15 to 17-second periods, the Vibration Engineering Company, using seismographs on the scene, reported: "The weight of explosives in even the largest blast could have been increased four times without the ground vibration even approaching the threshold of damage."

The sites were cleared not in 120 days as estimated, but in 75 days. The cost was $95,000, far below the $150,000 estimate. And not one workman had been scratched — or was even near the buildings when they went down.

A building in Pittsburgh presented quite a different problem: it wasn't tall enough for its own weight to



● **STACK** has hit ground except for about the upper third which is disintegrating. Accurate felling was a requirement.



● **FINAL** stage as top of stack hits soil barrier placed to cushion fall. Stack was 15 ft. higher than plans showed.

be counted on for total collapse. Loizeaux planted his basement charges in delays concentrically around the instant and MS caps at the planned center of collapse, then he called upon the fire department. The roof drains of the 4-story building were plugged, and the fire department loaded the structure with 6 inches of water. When the charges were fired, the weight of the heavy water load helped push the building in upon itself. The 60-lb. shot levelled the structure in 10 seconds.

Industrial Stack Demolition

Another of Burnbrae's fortes is industrial chimney demolition. The advantages of stack demolition by dynamite are several: it is quick, cheap and safe. No scaffolding is needed. With a minimum of drilling at the base, Loizeaux fells his chimneys with the accuracy of a lumberjack.

Perhaps the best example of his chimney work was the recent demolition of a boiler house stack. The brick stack, 110 feet high, was located in the "L" of the boiler house. The only open area for its fall lay immediately adjacent to another building. Loizeaux planted his charges to chop out a V-cut on the one clear side. Where the crown of the falling stack was expected to strike, he supervised the spreading of a soil berm to prevent the bricks from scattering.

A stiff wind swept across the area in 30-mph gusts. Loizeaux waited for a lull then pressed the firing switch of his blasting machine. The dynamite popped, and the big stack swung down in a 90-degree arc—crashing to the ground where the dirt cushion lay. Only 6½ lbs. of dynamite were used to bring down the stack.

One of Burnbrae's most serious problems is the attitude many contractors and public officials have regarding the use of dynamite anywhere but in a wide open area. They envision the popular misconception of a teeth-rattling detonation followed by flying debris, and the very thought of that is enough to bring about a thumbs-down on many a project where explosives would have saved weeks of conventional effort.

So conscious is Loizeaux of this psychological effect that he studiously avoids the use of anything even approaching a lurid description of his firm's operations. The word "blast" is eliminated from his vocabulary.

"People have turned down explosives on jobs where dynamite would have saved thousands of dollars, and they've done it because there have been accidents in the past. But we've found that they were often due to carelessness—not the powder man's carelessness, but that of the contractor he was working for. That's why we like to handle the whole dynamite operation and take full responsibility for it ourselves."

A case in point involved a bridge razing job some years ago by a demolition contractor—not a dynamiting specialist. The explosives were placed on top of the bridge and falling debris killed a photographer in the ravine below.

"A dynamite specialist would have cut that bridge's piers at the bottom," Loizeaux points out, "and he would have done it with delays to control the throw. The nearby area would have been combed then posted with guards." An explosives specialist can't afford a mistake. His reputation is the biggest single asset he has.

Though the use of explosives is on the increase, firms specializing solely in dynamite operations are few—probably less than half a dozen on the east coast, for example. But public officials, utility firms and contractors are becoming increasingly aware of the advantages of intensive explosives applications.

● **ON HIGHWAY** widening job, necessary hole drilling is done during daytime hours and blasts are fired after job is closed down for the night so work is not delayed.

CLEANING FREEWAY SIGNS

E. T. TELFORD,
Assistant State Highway Engineer, District VII, State Division of Highways, California Department of Public Works

THE CLEANING of freeway signs is a function of the District Maintenance Department which is charged with the duty of maintaining all State of California freeways and highways in the District. Maintenance in District VII is a responsibility of A. L. Himelhoch, District Engineer of Operations. Serving under the district engineer is W. D. Sedgwick, Assistant District Engineer—Maintenance, who has general supervision of all maintenance work in the District. Highway Superintendent L. R. Smith is in immediate charge of District VII field forces doing the highway and freeway traffic striping and signing which includes the cleaning of freeway signs.

District VII of the Division of Highways includes Los Angeles, Orange and Ventura Counties. It has an area in excess of 6,700 sq. mi. and a population of approximately 6,600,000. Topographically, it rises from the 130 miles of sea coast to mountain areas with elevations above 8,000 feet, then drops off into the Mojave Desert, with an elevation of about 2,500 feet. Temperatures vary from below zero in the mountain areas to above 120° in the desert. Moisture and precipitation vary from the comparatively dry desert areas to the more corrosive areas of the coast line, with its fog and high humidity.

The 280 miles of freeways and expressways completed to date contain more than 500 separate sign structures. Each sign structure supports from one to three signs, depending upon location and design. The signs vary in size from 40 ins. to 120 ins. in height and from 10 ft. to 36 ft. in length.

The location of the sign governs to a certain extent the frequency of desirable cleaning. Experience indicates that the average sign should be cleaned annually. However, since sign washing is an item of work that can be deferred in favor of other more urgent items, our cleaning program is sporadic and all too frequently includes only the most critical installations.

The equipment presently in use in this District consists of tower trucks, a 300-gallon sign washer, an Industrial Monkey and a Giraffe. Each piece of equipment is specialized and is used at specific locations.

Cleaning Crew

Normally, a two-man crew is sufficient for washing most of our signs; however, additional manpower and equipment are required at certain locations to provide for traffic control or flagging. On our newer type sign bridges where cat walks, drain spouts, and drip pans are in place, washing may be performed with little or no interference to traffic. On sections where it is necessary to close the outside lane of traffic, we may work only in the off-peak hours. Cones and high level warning devices are set out approximately 500 to 750 ft. in advance of the work to transition traffic out of the closed lane. On sections where the inside lane, or lanes, must be closed in order that signs may be washed, this work must be performed in the period having the lowest traffic volume. Old-type sign bridges and signs mounted on the face of overhead or separation structures, are typical of the type mentioned above. In these areas we perform this work on Sundays between daylight and approximately 9 am when traffic can be funneled into one or two lanes. Local Police Departments or the California Highway Patrol are always notified in advance of this type operation and one or more officers are specifically assigned to work at the area in question.

All of our overhead signs and most of our ground-mounted signs are made of porcelain enamel on either iron or aluminum sheeting and are reflectorized. Illumination is by fluorescent lighting tubes. This type of sign has an anticipated life of over 20 years if not damaged by vandalism or by accident. This material will not be damaged or its life shortened

● **CLEANING Freeway signs can be a major task with 500 separate sign structures. This is a late model sign with a catwalk which greatly simplifies the cleaning job.**

● **TOWER LIFT which is parked on paved shoulder is used for cleaning this sign on Hollywood Freeway, Cahuenga Pass.**

● **CLOSE-UP of sign washing equipment being used on a relatively small sign, with the tower lift parked on the shoulder.**

any standard cleaner that we have found available on the market; however, any reflective sheeting or baked enamel sign life may be adversely affected if harsh cleaners, stiff brushes, or abrasives of any type are used.

Illuminated Signs

The illuminated signs, when new, had a contrast factor of approximately 25 to 1 (measured in foot lamberts with a spectra brightness meter). Light readings have been taken on extremely dirty black and white signs and these have been found to have a contrast factor as low as 6 to 1. On some of these signs we have merely washed the white lettering with a good glass cleaner. Although the daytime appearance has been very favorable we find in checking these signs with the brightness meter that we have not improved the nighttime visibility to any appreciable extent. Therefore, on the basis of the above, it would appear to be mandatory that the entire sign panel and particularly the background surface, be cleaned. We have found that by using a wet method—detergent and water—we can do an effective cleaning job at the rate of 5 to 10 square feet per minute. This rate, however, is influenced by the amount of dirt on the sign, type of traffic encountered, traffic controls required, etc. Using the dry method—namely, with a paste or liquid applied directly to the panel and then wiped off by hand, we can do approximately 2 square feet per minute. While this method is more costly, it definitely does a superior job when used on those signs which are subject to the collection of diesel smoke or other foreign material. Actually it is the only satisfactory method we have found to date.

The washing of ground-mounted reflectorized signs is most effectively accomplished by means of a wet method — namely, mechanically washing with a standard detergent.

● **"GIRAFFE" used for washing Wilshire Blvd. Bridge. Because of the normally heavy traffic on this Freeway, work is done on Sunday morning when travel is light.**

Crew Requirements

When considering the large number of ground-mounted and overhead signs in this district in conjunction with information gained from our sign-cleaning studies, it would appear that it will be necessary in the near future to establish a special two-man crew to handle this item of highway maintenance. They, of course, would be supplemented by additional men when required for more efficient operation. This crew will require a ladder truck and our present sign washer. The Giraffe, tower truck, and other specialized equipment normally utilized by our Signal Maintenance Department will also have to be made available when not in other use.

Based on past experience, we would expect that this crew would wash every sign on our present freeway and expressway system, both ground-mounted and illuminated, at least once a year and in addition would be able to clean the problem signs at more frequent intervals when required.

We have in this article attempted to describe our methods in connection with cleaning overhead illuminated signs, and thus bring to the attention of the design engineer and the specification writer some of our specific problems.

SUBURBAN SEWERS COST LESS WITH INTEGRATED PLANNING

FRED G. GOFF,
Administrative Assistant,
Orr-Schelen, Inc.,
Minneapolis, Minnesota

GREAT INCREASES in home building since the end of World War II have made it imperative for many villages to develop water and sewer systems to replace private wells and cesspools. The problems encountered by the Village of Richfield, Minnesota, a suburb of Minneapolis, are typical. Richfield has an area of approximately 8 square miles. The terrain is, in general, level with five small lakes in the corporate boundaries. The population in 1940 was 3,800; by 1950 had increased to 17,502; in 1956 was 36,500; and the peak to be expected for the remaining area is estimated at 39,000.

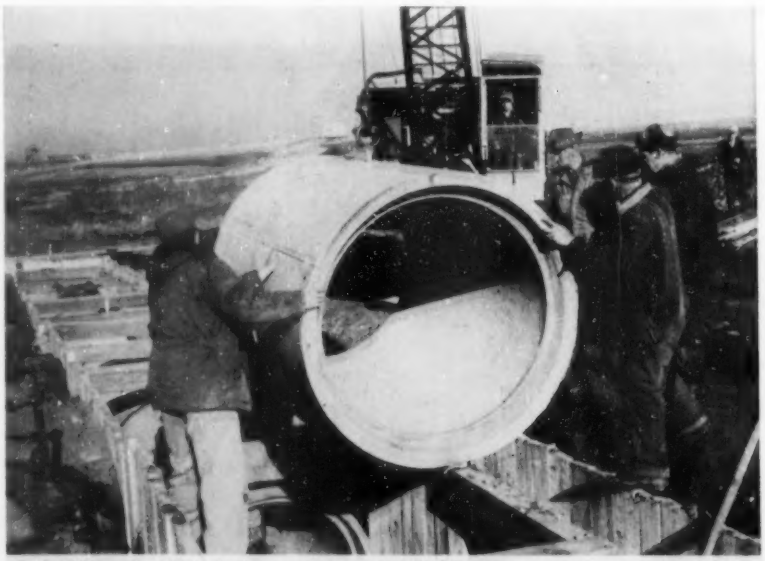
As a result of a study by a 15-man lay committee, the G. M. Orr Engineering Co. was engaged to review the sanitary problems of the village and submit recommendations for development of an overall system. This was completed in 1952. The Village Council had the foresight to order a complete set of master plans of the storm and sanitary sewer layout, which enabled the engineering department to advise building developers at what level to build structures to assure getting sanitary sewer service and avoid storm water drainage problems. Also, sanitary and storm sewers could be built in small sections if desired.

The consulting engineers immediately began the work necessary to develop and obtain approval of this long-range plan. Comprehensive plans for the Richfield sanitary sewers were reviewed by the Minneapolis Engineering Department and the Minneapolis City Council approved the request to connect to the Metropolitan System. Design for the trunk sanitary sewer system for Richfield was approved by the Minnesota Board of Health. The Village of Edina was contacted and was offered the use of a portion of the Richfield system to pass its sewage on to the Minneapolis System. A contract was drawn and joint approval obtained from the Village of Edina, Richfield and City of Minneapolis.

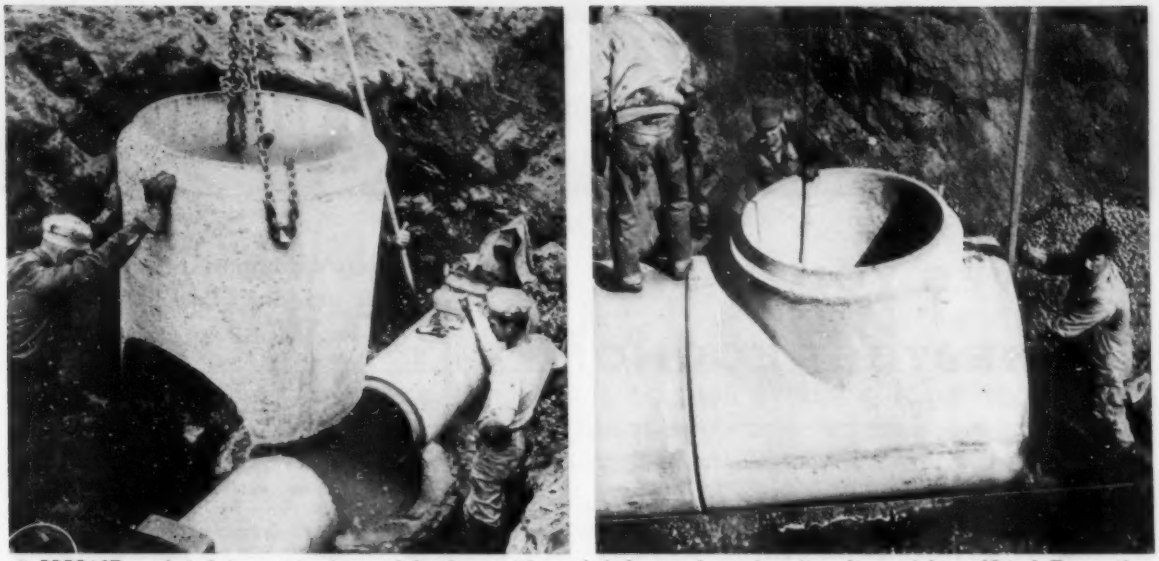
The next step was research necessary to prepare plans for construction of the first trunk sewer system. After a careful study of the terrain and population demands, the estimated flow contributions for Richfield and Edina were established, based on Minnesota State Board of Health standards for trunk sewers of 250 gpcd plus an infiltration factor of 300 gallons per acre. For Richfield, a population figure of 60,000 was used as the equivalent design factor to cover future village development which might include heavy industrial and commercial contributors to the system. On this basis, the flow to the Minneapolis sanitary sewer system would be 18 cfs from Edina and 24 cfs from the Village of Richfield.

The Village of Richfield engineering department was contacted and recommendations for street grade changes were made to effect savings in construction cost. As a result of these changes the number of lift stations was reduced, thus effecting an immediate construction savings to the village and a long range savings in servicing, repair and maintenance of the lift stations.

The master sanitary sewer plan when completed proposed that approximately 130,000 l.f. of main trunk sewer, 600,000 l.f. of lateral sewer, and 500,000 l.f. of house service sewer would be required to give the Village of Richfield a complete sanitary sewer system. The trunk sewer pipe sizes for the first interceptor would range from 12-in. to 48-in. and the work would be completed within 3 years of the starting date. The Resident Engineer appointed for the construction was Robert D. Garvin. The engineering firm was fortunate in obtaining the services of Robert A. Huston, for-



● **LAYING the 48-inch line to connect the Richfield sewerage system with that of Minneapolis. Design flow to the Minneapolis system was estimated at 42 cu. ft./sec. based on a flow of 250 gals/capita/per day plus infiltration at 300 gals/acre/day.**



● **PRECAST manhole being put in place at left, above, with manhole base and entering pipes shown; right, a 48-inch Tee section.**

mer Sewer Engineer with the City of Minneapolis for 40 years, as Project Engineer.

Construction of the trunk sanitary sewer system was begun in March of 1953 and completed in three projects by January, 1955, at a total cost of $2,767,718. A total of 121,773 l.f. of main line sewer and 45,949 l.f. of house service sewer were installed. Four lift stations and one meter station were constructed at a cost of $159,251. The Village of Edina contributed $609,580 toward the cost of the trunk sewer system and the Village of Richfield was required to pay $390,000 to the City of Minneapolis for alterations required in its system.

Lateral sanitary sewer system construction began in September, 1953, to serve the business area. Remaining major lateral sanitary sewers were completed in July of 1957. The final lateral sanitary sewer necessary to serve all built-up areas of the village was ordered constructed by the Village Council in the summer of 1958. In the future, private developers will be required to provide utilities for any unplatted areas they wish to develop.

The estimated total cost of the lateral sanitary sewer system for the built-up areas was $3,180,791. It should be noted that the total cost of the projects given in the study are construction costs, to which must be added the engineering costs, legal fees, assessment rolls, and miscellaneous items. The average construction cost of the trunk sanitary sewer, including all items, was approximately $13 per lineal foot. The special assessment levied against the benefited property in the village was $1.25 a foot for the short side of platted property and $300 an acre for unplatted property. The property receiving lateral benefit from the trunk sewer was assessed a charge of $3.49 a lineal foot on the short side of the lot and a $75 charge was made for a house service stub.

The average construction cost of sanitary lateral sewer built was approximately $5.30 per a lineal foot, including all items. The special assessment levied against benefited property was $3.85 a front foot with an average charge of $77 for each house service stub installed. This cost was considerably lower than for sanitary sewers built in other suburbs in the metropolitan area since the beginning of the Richfield system. The grid type platting of the suburb also made the assessable cost to the property owners somewhat less than in other areas.

● **REINFORCED concrete pipe was used for this deep manhole. Method of placing outside drop section is shown.**

The Village of Richfield is one of the few new suburbs in the area which has a nearly complete sanitary sewer system. The additional construction necessary is in unplatted areas where it will be the responsibility of the individual land developer to furnish all utilities. The only problem remaining is installation of a water system.

The Village of Richfield was wise to concentrate its efforts and financial resources to complete the sanitary system at the earliest possible date. Construction costs have increased 10 to 15 percent in the ensuing years. The Village also benefited by ordering a complete master sanitary and sewer plan that permitted either partial or complete construction of the system. Any municipalities contemplating sewer and water construction might well follow the lead of Richfield in developing a long-range overall master plan for its major utilities. The Village is under a Mayor-Council-Manager System of government and in 1953 won the All-American City Award for civic improvement and achievement. The administrative operation of the Village is under the direction of Orville R. Van Krevelen and the engineering department is directed by Leo Jolly.

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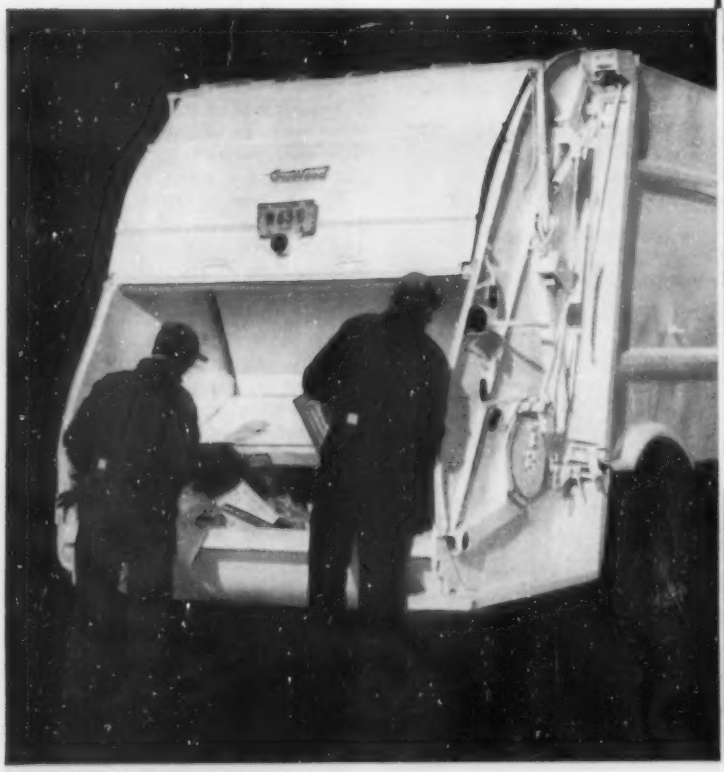

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Clifton, N. J. Host to N.Y.-N.J. Metropolitan Chapter

Clifton, N. J.—The spring meeting of the New York-New Jersey Metropolitan Chapter, for which Clifton, N. J. was host, drew an attendance of about 550 registered members and guests. Fifty manufacturers and dealers sponsored the exhibit of equipment. The all-day meeting included luncheon, informative talks, a field trip, cocktail hour and dinner. William Holster, City Manager of Clifton, was meeting chairman.

After a fine luncheon of steak prepared by the city employees, the meeting was called to order by August E. Zentgraf, President of the Chapter. Robert D. Bugher, Executive Director of APWA, brought a message from headquarters to the members. It was announced that W. Fred Welch, Senior Hydraulic Engineer, Nassau County Dept. of Public Works, will be the Chapter nominee for the Charles Walter Nichols award.

The technical program, a panel discussion on new municipal garages, was presided over by Richard J. Lynch, Assistant City Engineer of Clifton. The following papers were given by the panel: "Planning and Study," by Joseph Rosenthal, President, Engineers, Inc.; "Financing," by Robert T. Eichman, Treasurer, Village of Rockville Centre, Long Island, N. Y.; and "Analysis of a Recently Completed Garage," by Arthur Mazowiecki, Dept. of Public Works, Clifton. After the technical meeting a field trip visited the Little Falls plant of the Passaic Valley Water Commission. This plant treats approximately 86 mgd of water and serves a population of over 475,000.

The day's events were concluded with a family style ham and chicken dinner at the Friar Tuck Inn attended by over 250 people. Mayor Stanley Zwier of Clifton expressed a welcome to the Chapter and Bob Bugher gave another interesting address.

Five Cities Receive Public Agency Certificates

Chicago, Ill.—Five cities, Whittier, California, Shorewood, Wisconsin, Malverne, New York, Richland, Washington, and St. Charles, Missouri, completed ten years as public agency members of APWA recently and have been awarded Certificates of Appreciation from the Association. The rapid growth of APWA during the past decade is strikingly demonstrated by the fact that almost 250 governmental units currently have such memberships. The Certificates were presented formally to designated city officials at chapter meetings this Spring.

Public Agency memberships are a special type membership available to governmental jurisdictions —Federal, State and Local. Their cost is based on population and directly reflects the number of individual active members that can be designated. For example, the cost of a public agency membership for a city of 45,000 is $50.00 annually. This city can designate 5 public officials concerned with public works activities to receive full active membership status in APWA. One-half of the funds so received is allocated to the Association's Research Foundation.

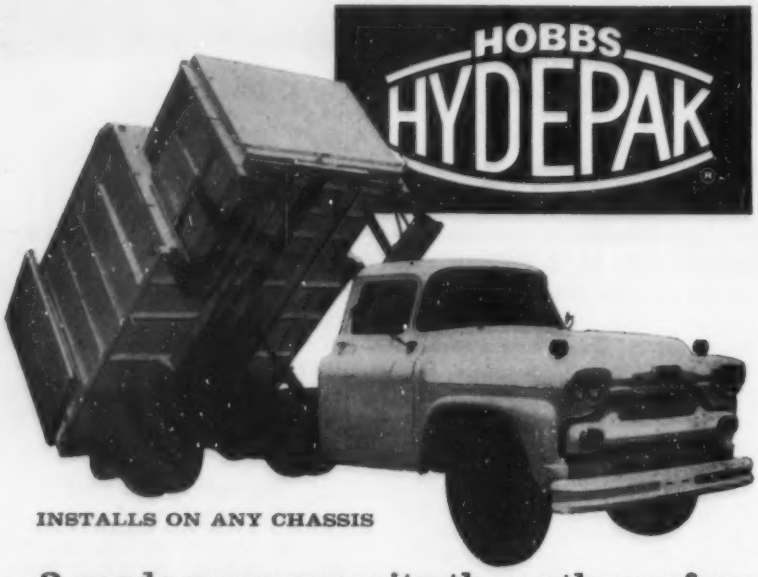
"Serve With A Smile" Editor Tells Ohio Chapter

Toledo, Ohio—Paul Schrader, Director of News for the Toledo Blade, addressed the members of the Ohio Chapter meeting in Toledo's Commodore Perry Hotel May 7 and 8 on "Public Relations for City Officials". Acknowledging that people who dedicate themselves to working for others deserve more praise than they receive, Mr. Schrader pointed out that public officials often are comparatively unhappy because of economics and the pressure of politics. However, he emphasized that one needs to be happy to have proper PR and urged that public officials "serve with a smile." Stressing further that good PR demands a continuing program, he cited the importance of cordial contact with the public in answering the telephone and the need for a free flow of information from City Hall. In conclusion, Mr. Schrader stated "Do take your job seriously, but not yourself!"

The balance of the program consisted of concurrent functional group discussion on public works problems including street maintenance, waste collection and disposal, building maintenance, intergovernmental street and sewer problems, equipment maintenance, emergency ice and snow removal, metropolitan expansion, street lighting assess-

OFFICERS: Wm. D. Hurst, Winnipeg, Manitoba, Canada, *President;* Jean L. Vincenz, San Diego, Calif., *Vice President.* REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. *Immediate Past President,* Sol Ellenson, Newport News, Va. Robert D. Bugher, *Executive Director.*

Greater capacity means fewer trips to dump with



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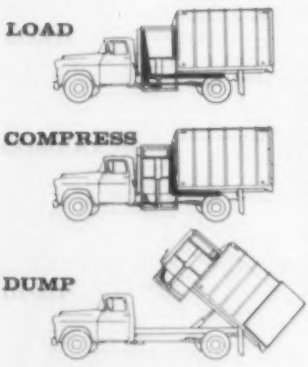
...3 yards more capacity than other refuse packers of comparable weight and cost!

Three yards more *compressible* capacity – inside the main storage compartment – means several more blocks can be covered by a Hobbs Hydepak before it's necessary to go to the dump site.

LOOK AT THIS COMPARISON:		Hobbs Hydepak Model 1619	Body G	Body P
**Measurements by an independent testing laboratory for a major Southwestern city.*	Body Volume, cu. yds.	**16.2**	**12.7**	**12.9**
	Empty Weight, lbs. (including weight of trucks)	**12,180**	**13,740**	**12,280**



Volume, as measured above, is body space into which refuse can be *completely compressed* and does not include the three-yard loading compartment at the front. When you buy a refuse collection body of a given capacity make sure how much of the total volume is really *compressible* volume, and how much is in the loading hopper, where only partial compression is possible. There's a big difference!

Available in 13, 16, 20 and 24 cu. yd. capacities (not including 3-yard loading compartment).

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ments, and overall municipal problems. Three concurrent sessions were scheduled during each of two afternoon periods and one morning period. They were conducted informally and found to be very effective as a means of exchanging experience.

W. C. Wichman, Director, Department of Public Works, Cincinnati, was elected President for 1959-1960 succeeding Fred Hughes, Director of Public Works, Springfield. Other chapter officers elected are Louis L. Drasler, Cleveland, Vice President; and Joseph C. Weber, Toledo, Secretary-Treasurer. Don Mackley, Delaware, Jack Unterberger, Dayton, and F. L. Woodcock, Akron, were elected Directors.

First Annual Texas Public Works Conference

Ft. Worth, Texas—The Texas Public Works Association held its first spring meeting in Fort Worth on May 14 and 15. The spring meeting was inaugurated to provide additional opportunity for public works officials to come together to discuss "Texas" size public works problems and practices. Present for the occasion were C. C. Crutchfield, Field Consultant, Texas Municipal League; Robert Bugher, Executive Director, American Public Works Association, and Jean L. Vincenz, Director of Public Works, County of San Diego, California and Vice President of the American Public Works Association. The TPWA is affiliated with the Texas Municipal League and the American Public Works Association.

Utah's Eighth Annual City Streets and County Roads School Held

Kanab City, Utah—The Utah Municipal League, the Utah State Association of County Officials and the Utah Chapter of the APWA jointly sponsored the eighth annual city streets and county roads school held in cooperation with Kane County and the City of Kanab. The annual Utah School is specially designed for city and county officials in charge of streets and roads and for personnel in charge of construction and maintenance. The 1959 school featured a presentation on "The Federal, State, City and County relationship on maintenance of Federal aid projects" by Elno R. Morgan, Director of Highways, Utah State Road Commission, and R. E. Simpson, District Engineer, U. S. Bureau of Public Roads.

Also featured were talks by W. R. Howat, District Engineer Asphalt

OCT. 10, 1954: 6" SNOW AND SLEET—CLEVELAND, OHIO
OCT. 28, 1951: 5" WET SNOW—UPPER NEW ENGLAND
OCT. 25, 1955: FREEZING RAIN—CHICAGO AND DETROIT
OCT. 24, 1956: 3" SNOW, FREEZING RAIN—SOUTH DAKOTA
OCT. 20, 1952: 4" SNOW—WILKES-BARRE-SCRANTON, PENN.

(Source: U. S. Weather Bureau Climatological Data)

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INSTANT BRUSH DISPOSAL
FITCHBURG CHIPPER
DOES 3 MEN'S WORK

When you want to cut brush disposal cost, investigate a Fitchburg Chipper, a real time and labor-saver.

John Glasgow, Superintendent of Public Works, Township of Mahwah, New Jersey, says: "Now I chip brush instead of putting it on piles and waiting for wet weather to burn. I mention wet weather because of fire hazard.

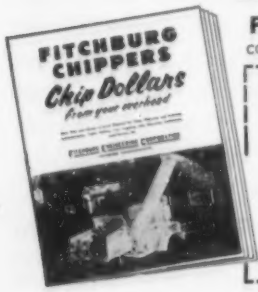
"The Fitchburg Chipper was purchased in May 1954. It will take only a short time to pay for itself. I hired 6 men to cut and clean up brush, now with the Chipper I only need 3 to do the same work."

You, too, can save man hours where there is a need for line clearance operations, road clearance, thinning out woodlots, or handling the brush problem on parkways, city streets, etc.

The Fitchburg Chipper is designed for rugged use, and in models priced from $960 upward.

Learn about Fitchburg's exclusive spring-activated feed plate, which makes chipping of all sizes of wood (up to the machine's rated capacity) simple. Another exclusive feature is the hinged feed apron which can be closed when not in operation.

Read how others cut labor costs with a Fitchburg Chipper—the only chipper that gives you a one-year guarantee.



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Institute, Denver, Colorado; Harry C. Clausen, Salt Stabilization Specialist, Morton Salt Company, Chicago; and Ralph E. Spears, District Engineer, Portland Cement Association.

Survey of Sewer Rental Programs in Western Pennsylvania

Pittsburgh, Pa.—William G. Willis, Director of the Institute of Local Government, University of Pittsburgh, Pittsburgh, Pa., and President of the Western Pennsylvania Chapter, has announced publication of a report on sewer rental programs in effect in various Western Pennsylvania communities. The 70-page report was prepared by the Institute and The Research Committee of the Western Pennsylvania Chapter and includes data on programs adopted by 47 political subdivisions and one of three public utility companies providing sewerage facilities in Western Pennsylvania. Approximately 50 percent of the 48 rental programs reported became effective within the last three-year period. Data for each subdivision includes effective date of rental program, minimum rental charge, whether institutions are exempt from rental, and whether a sewer connection permit, tap in or connection fee or advance deposit charge are required.

University of Wisconsin Student Receives Chapter Award

Madison, Wisc.—The 1959 Wisconsin Chapter outstanding Student Award was bestowed upon Walter Durant, a Civil Engineering Student at the University of Wisconsin. The Award consists of an honorarium of $100 and is given each year to a deserving student selected by a University Faculty Committee. Presentation was made at the May ASCE Student Chapter Meeting by John G. Thompson, City Engineer, Madison, Wisconsin and Secretary-Treasurer of the Wisconsin Chapter of APWA.

Hands Across the Border

Grand Forks, N. D.—The North Dakota Chapter held its annual meeting in Grand Forks during April. APWA President William D. Hurst and twenty fellow Canadians were in attendance.

The "international" program consisted of a morning panel on "Sanitary Landfill Up North" with Everett Lobb, North Dakota State Health Department; Edo Carlson, Bismarck City Commissioner; Vern Fahy, Public Works Director, Minot; Don Cuskelly, City Engineer, Dick-

Help for the fall round-up

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You don't need a gang of men with brooms and shovels rounding up stray leaves and debris when a "PAYLOADER" with Drott 4-in-1 bucket is on the job, and you don't have to close a street to traffic for clean-up either. The "PAYLOADER" can work close and parallel to the curb, while its clam-action bucket picks up sweeper piles cleanly and dumps them over the truck's tail gate.

Over 10,000 "PAYLOADER" units have gone into public service — more than all other rubber tire unit-design tractor-shovels combined. A big reason for this preference is the wide choice of attachments — many of them exclusive, that make "PAYLOADER" units more versatile — enable them to take the place of specialized machinery in many instances.

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inson; Don Venaas, City Engineer, Jamestown; and John Kleven, City Engineer, Grand Forks participating. An afternoon panel on "Exchange of Ideas Across the Border" was moderated by W. H. Finnbogason, Streets and Traffic Engineer, Winnipeg.

During the afternoon panel John Baker, Superintendent of Construction, City Engineering Department, Winnipeg discussed "Safety in Construction." Thorburn Peterson, Assistant City Engineer, Grand Forks discussed "Variation in Design—Pittsburgh vs Grand Forks." Don Cuskelly, City Engineer, Dickinson, discussed "Maintenance Cost of Dickinson Lagoon Sewage Disposal", and M. Jeroff, Municipal Engineer, Municipality of West Kildonan, Manitoba, Canada, discussed "Public Relations in Municipal Engineering."

The session closed with a business meeting wherein William B. Lukins, Asst. City Engineer, Bismarck, was elected President; Don Wenaas, Vice President; Vernon Fahy, Secretary-Treasurer, and new members to the board Jorgon Miller and Donald F. Cuskelly.

Hawaiian Holiday

All members and visitors planning to be in Seattle for the Public Works Congress and Equipment Show this September are invited to join a post Congress Trip to the Hawaiian Islands—our new 50th State.

The Hawaiian Holiday begins on September 23 when the group will fly from Seattle to Honolulu. Luxurious lodging is provided at the new Hawaiian Village Hotel at Waikiki Beach. Attractive sightseeing programs and special entertainment are included . . . also a trip to the Outer Islands of Kauai and the Big Island of Hawaii is available.

An attractive economy trip by air is featured at a cost $295 per person. A more elaborate air tour providing a longer visit in the Islands may be had for approximately $547. Those desiring to fly from Seattle to Honolulu but return via the palatial Matson luxury liner, the *Matsonia*, may do so at a minimum cost of about $570 per person.

Colorful, descriptive literature and a brochure giving complete details on this exciting and timely adventure to the tropical palm-fringed shores of beautiful Hawaii may be had by writing: Harvey R. Mason Travel Co., 64 Old Orchard, Skokie, Illinois.

• • •

Regulation of Public Utilities on Road Rights-of-Way

It is necessary to regulate the activities of private and publicly-owned utilities in their use of the road right-of-way in order that their installations will not interfere with each other, nor with the normal functions of the highway. The location of both overhead and underground installations in Wayne Co., Mich., are selected to provide the least interference with trees, shrubs and other landscape features of the roadsides.

To protect the trees and shrubs and to provide for orderly roadsides, occupancy by utility companies and others is allowed only by permit. All applications are field-checked and foresters inspect the work while in progress and after it is finished. The licensees are released from all responsibilities only after they have fully complied with the conditions of the permits.

Permits for public utility construction and maintenance work on state trunklines are issued by the Michigan State Highway Department under recommendation and inspection of Foresters of the Roadside Development and Maintenance Division of Wayne County, Mich.

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AWWA Standard Bell Spigot Watermain Fittings—2" through 36".
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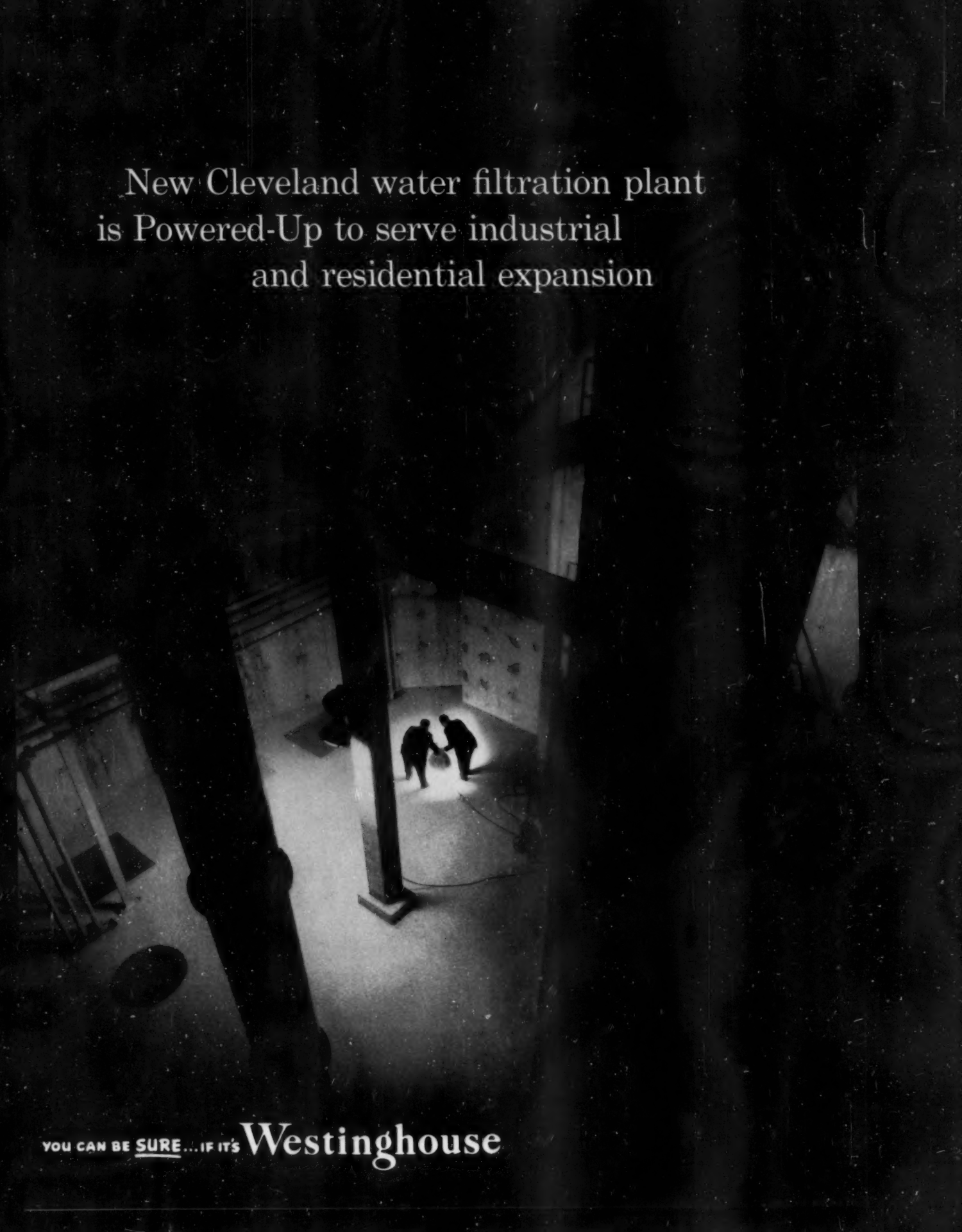
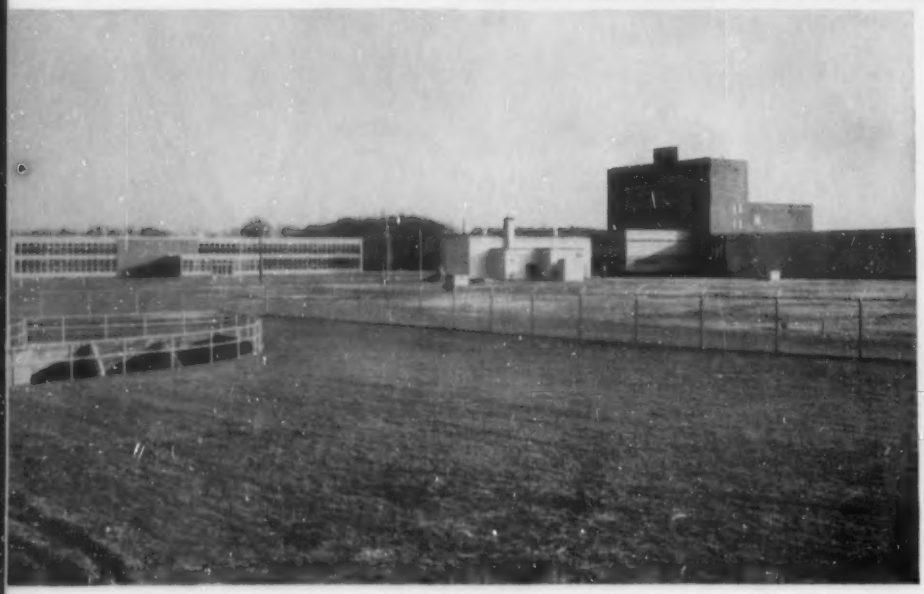

New Cleveland water filtration plant
is Powered-Up to serve industrial
and residential expansion
YOU CAN BE SURE... IF IT'S Westinghouse

Cover photo:
View of raw water pump suction wells illuminated by Westinghouse VEK-16 floodlighting.

Project group discussing layout of Crown Filtration Plant includes J. E. Hrovat, Vice President of Engineering, Doan Electric Co., Electrical Contractors; E. E. Croushore, Westinghouse Construction Sales Engineer; L. O. Meyer, Branch Sales Manager, WESCO, Cleveland; Dan Kasych, Assistant Superintendent, Pump Building; G. L. Baughman, Chief Electrical Engineer, Havens and Emerson, Consulting Engineers; S. C. Simmermacher, Chief Mechanical Engineer, City of Cleveland; M. B. Trimble, Westinghouse Construction Sales Engineer; E. S. Goulder, President, Doan Electric Co.; and H. M. Stafford, Salesman, WESCO, Cleveland.

J-94123-2



Over-all view of Crown Filtration Plant, Cleveland, Ohio. Pump building is at left and the filter building at right. Westinghouse OV-20 street lighting was provided for plant entrances and roadways.

Dan Kasych and E. E. Croushore examine one of the two Westinghouse 5000-kva power transformers which step incoming 34.5-kv service down to 4160 v for main pump drives.

Westinghouse system provides for 100% electrical load increase in new water pumping station

The new Crown Filtration Plant was designed to meet the growing need for water supply in the westerly suburbs of Cleveland, Ohio, and, as an important part of that planned expansion, the Westinghouse electrical system presently installed provides for 100% load increase without adding to the system.

The pumping station-filtration plant is located on a 55-acre site and is the newest addition to the city's expanding water supply system. Construction was started in 1953 and completed in 1958, and represents nearly a $20,000,000 investment. Present plant capacity is 50 mgd; but, because of anticipated future requirements, the plant has space and provision for additional equipment to provide capacity of 100 mgd.

Raw water is obtained through a crib 2½ miles offshore in Lake Erie. The water from the crib is carried through a connecting tunnel to a raw water well, where its handling is taken over by raw water submerged pumps. Treatment and flow of the water from this point through the filtration plant are automatic and exactly controlled, leading finally to a 15-million-gallon filtered water reservoir located in the southwest corner of the plant area. High service pumps deliver the water from the reservoir to both the low pressure zones and the first high pressure zones supplied by the Crown plant.

The major electrical elements supplied by Westinghouse to Power-Up this filtration operation include:

Two 5000-kva power transformers—to step utility service from 34.5 down to 5 kv.

Main metal-clad switchgear—to control and distribute power to motor starters (for L.S.) and provide for starting of H.S. motors (1750 hp).

Dry-type power center—to provide 480-v service to plant auxiliaries.

Westinghouse lighting throughout the plant area, including fluorescent, incandescent, street lighting and floodlighting.

In addition, Westinghouse supplied the many lighting and distribution panelboards required in the plant's operation.

The planned Powering-Up of the Crown Filtration Plant means it can meet all foreseeable future requirements with a minimum of modification. Additional water handling and treating facilities can be installed in areas already provided for them. And all such additional equipment can be operated without adding to the existing electrical distribution system.

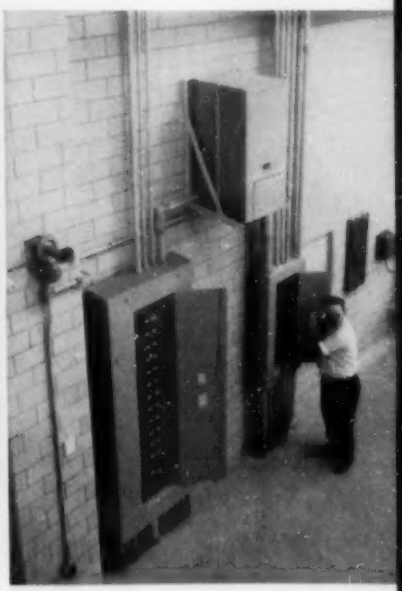
(*contd.*)

YOU CAN BE **SURE**...IF IT'S

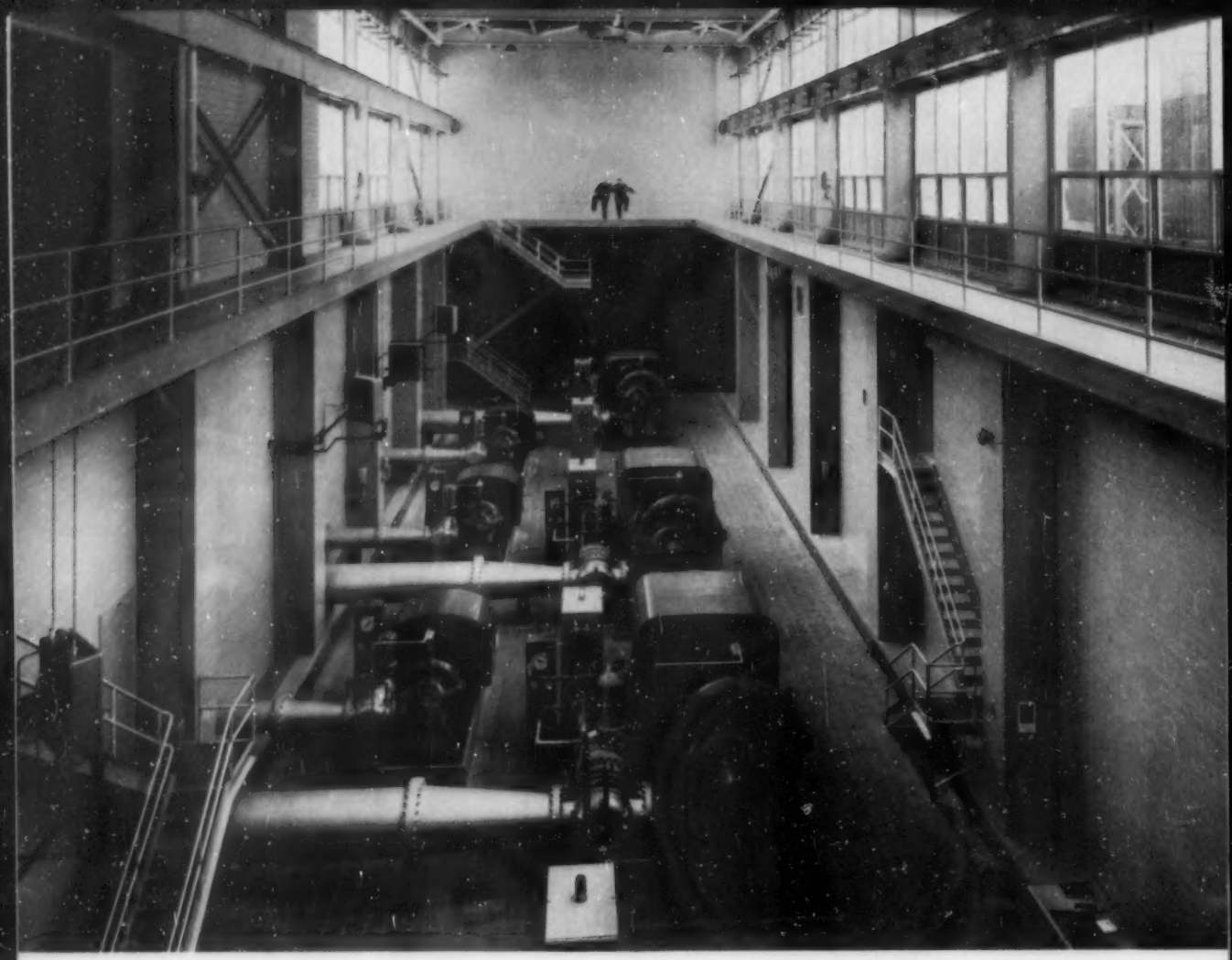
Westinghouse

View in main switchgear room with G. L. Baughman, M. B. Trimble and S. C. Simmermacher examining Westinghouse metal-clad switchgear. Lineup at right contains main incoming line breakers, bus tie breaker, reactor starters for high service pump motors, and feeder breakers for power center and low service pump motor starters. Five-kv bus duct overhead provides connections from metal-clad switchgear to Ampgard* high-voltage fused starters at left. *Trade-Mark

Dan Kasych inspects switchgear room. Westinghouse 225-kva power center utilizes dry-type transformers and DB low-voltage air circuit breakers to supply power panels throughout pump building. Room lighting is Westinghouse 2 SPC-75 slimline fluorescent luminaires.

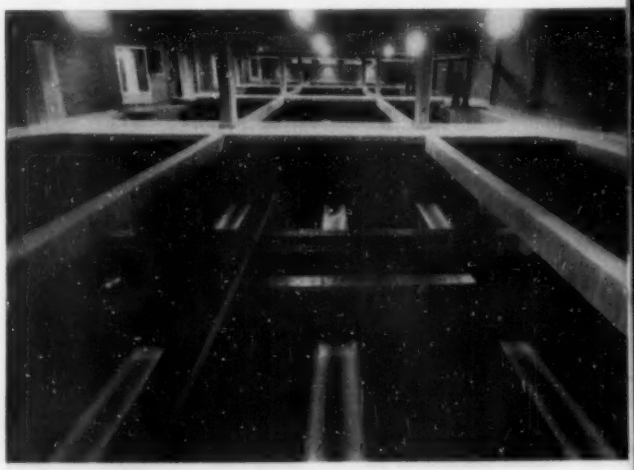


Westinghouse CDP power distribution panelboard and wall-mounted 37.5-kva dry-type transformer feeding NLAB lighting panelboard. J-94123-3



Section of main pump floor showing the three 25-mgd high service pumps and three 8-mgd low service pumps which are presently installed. Metal-clad switchgear cubicles and Ampgard high-voltage starters for these and two additional future pumps of each rating are installed in the main switchgear room. High bay mercury-vapor lighting is provided by Westinghouse Millite® luminaires.

View in filter building showing row of clarified water filter beds. Under average flow conditions, the 12 filters in the plant will pass a total of 50 mgd. Lighting is supplied by Westinghouse VEK-16 floodlights.



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Electrical system provides for 100% load increase

Powering-Up electrically for future growth can mean important benefits and savings for you. For further information, call the Westinghouse electrical construction engineer nearest you, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94123-4

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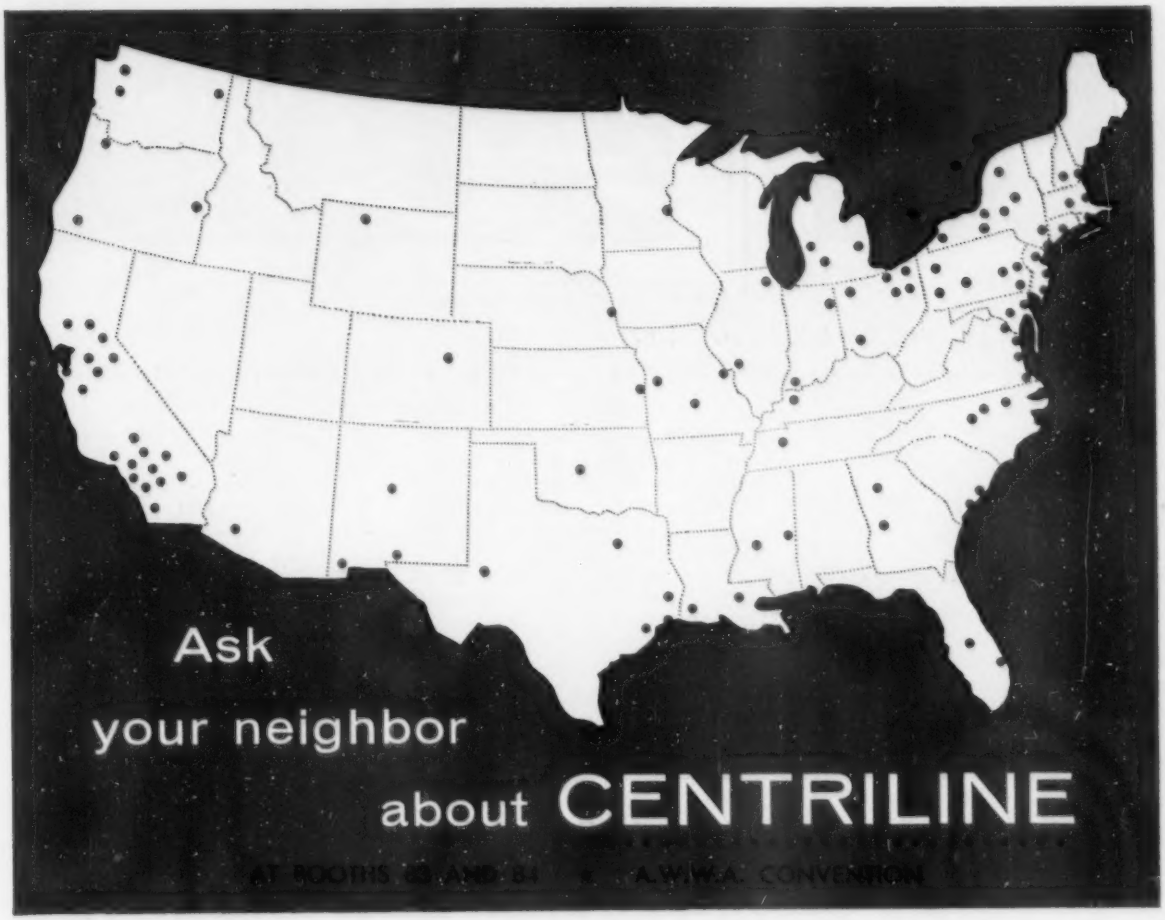

Spotted on this map are some of the places that have been served by the Centriline Process

Chances are that one of your colleagues has rejuvenated some of his city's piping by Centriline reconditioning. Here's your chance to find out.

Briefly, this process smoothly lines piping—*in place*—with cement-mortar, creating a pipe-within-a-pipe. This vastly increases carrying capacity, stops leakage, prevents corrosion and tuberculation, and prolongs pipe life indefinitely. Pressure goes up, pumping cost goes down, and there's no need to disturb traffic to replace mains. Over 6,000,000 feet of piping, from 4" to 144" diameter, have been treated by Centriline. *Ask your neighbor.*

Write today for a list of nearby officials whose cities have cut inconvenience and costs with this pipe-saving process. Hear what they have to say about Centriline. Then write or call us. We'll be glad to show you how Centriline can help *you* solve the problems of pipe conditioning.

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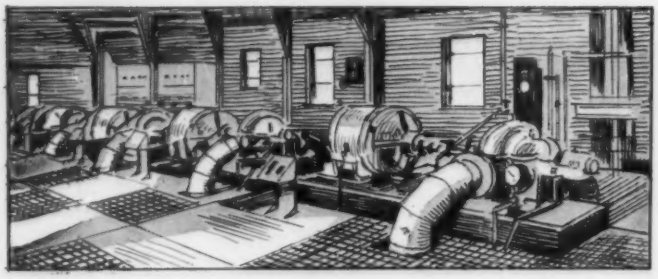
THE
WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Radio Communications

Water utilities are eligible for licensing by the Federal Communications Commission (FCC) in the use of radio service along with the electric, gas and steam utilities. In California the growth of two-way radio use by water utilities has matched or exceeded that in the rest of the country, the number having increased from 13 utilities licensed in 1947 to 148 licenses in 1958. Of those licensed in the State, 92 were municipal water departments, private water companies or irrigation districts. If operating conditions are right for mobile-radio dispatching, and it is used correctly, service can be improved and operating costs cut. Two-way radio does not solve all problems, however. Many factors must be considered before a utility can be sure that it will be able to use two-way radio successfully. The first and simplest means of mobile-radio communications is the one-way signal method in which the dispatcher transmits a radio signal to the vehicle's receiver, which sounds a buzzer and flashes a light. The driver pushes the switch, resetting the receiver for the next call, and proceeds to the nearest telephone to call the dispatcher. The equipment is owned, installed, and maintained by the serving company. Slightly more complex is the paging service, usually available only in the larger cities. To contact a subscriber, who is equipped with a small pocket receiver, his office simply telephones the paging service headquarters, where operators send out the appropriate call signal number by radio. In a typical system this signal is repeated every 1½ minutes for about ½ hour, and is the subscriber's cue to call his office. The third method is the extended or mobile, telephone. This is a form of two-way radio which allows communications by telephone between a vehicle and any regular telephone, as well as between two vehicles. A fourth method, combining telephone and two-way radio, provides most of the advantages of radio communications without the expense of a base station. The companies offering these four types of services are licensed by the FCC, and the utility, therefore, does not need a license. The fifth type, i.e. private two-way radio, requires the user to be licensed. This system usually consists of a base station and its affiliated mobile stations, all operating on one frequency. Of the five types of radio communication described above, two-way radio has proved to be the most popular. The author also discusses the installation, maintenance and original costs of the different types of communication systems.

"Radio Communications for Water Utilities." By Lee B. Hertzberg. *Jour. A.W.W.A.*, May, 1959.

Lime Waste Recovery

Dayton's new lime recovery plant benefits the city in two ways. It produces substantial savings in the cost of lime required for water treatment and produces revenue through the marketing of surplus lime. Also, it eliminates a difficult waste disposal problem. Until recently the waste lime from the water softening plant —an average of 42 mg treated per day—was discarded as plant waste. The new 150-ton per day installation, incorporating a 9½ by 265 foot rotary kiln, permits recovery and recirculation of the lime in closed

BDSA National Defense Executive Reserve

● **A CONFERENCE of the Business and Defense Services Administration was held in Washington, May 12 and 13, with over 600 reserve executives in attendance. Of the 43 reservists of the Water & Sewerage Industry and Utilities Division, Walter Picton, Director, 25 were present. These included 11 from utilities, 12 from manufacturers and two from consulting engineers. The picture shows this group, with H. B. McCoy, BDSA Administrator, at the center.**

IOWA *valve installation at Fort Dodge, Iowa, pumping station which pumped 1,600,000,000 gallons of water in 1958 as against 350,000,000 gallons in 1932.*

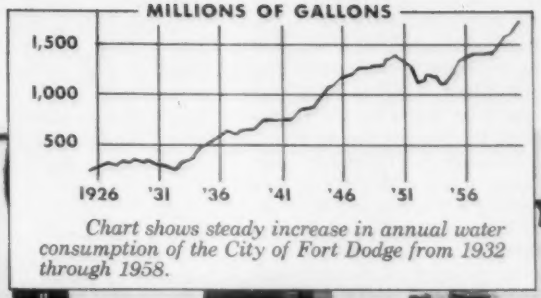
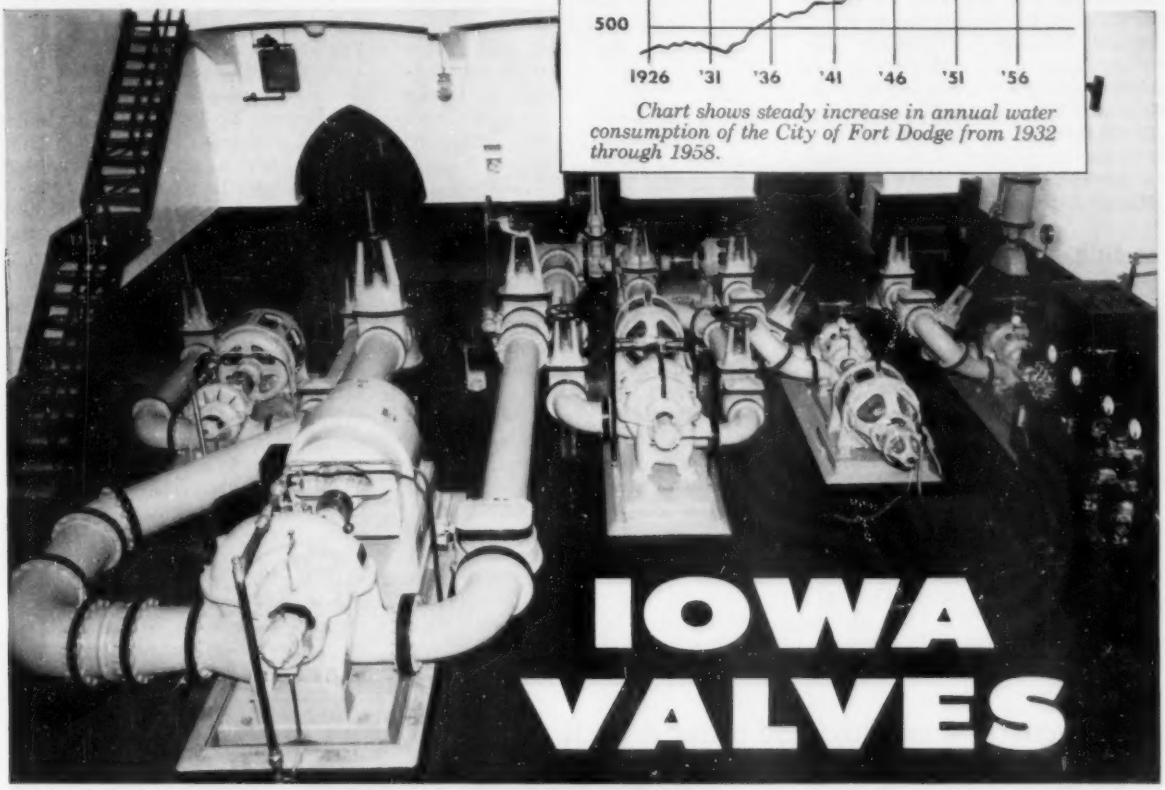


Chart shows steady increase in annual water consumption of the City of Fort Dodge from 1932 through 1958.



...enable Fort Dodge waterworks to meet 457% increase in demand in 26 years

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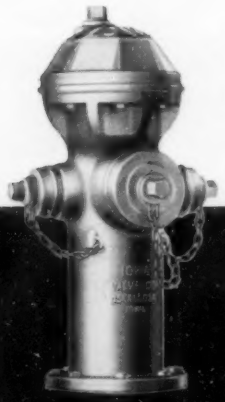
For over 26 years, IOWA Valves have played an important part in meeting the water needs of the growing City of Fort Dodge, Iowa. For half a century IOWA and IOWA service have been growing to meet the needs of towns and cities from coast to coast.

Few manufacturers can match IOWA in the wide variety of valves and accessories for every type of service. IOWA valves meet the most exacting specifications for flow control in distribution and fire protection systems, sewage treatment and water filtration plants. It will pay you to call in an IOWA man before placing your order.



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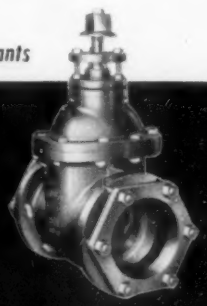

IOWA
VALVE COMPANY
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Oskaloosa, Iowa

circuit. Moreover, since the water treatment process and subsequent calcining operation produce more lime than is needed, the surplus produces revenue for the city. The treatment plant also utilizes the waste gas from the kiln for recarbonation of the water prior to filtration. A description of the facilities, with photographs, and their operation, is presented in the article. Savings and income should pay for the $1,500,000 plant in about 20 years.

"Lime Recovery Transforms Waste to Income." By R. C. Stout and E. C. Mertz. *American City*, May, 1959.

Multi-Reservoir System Control

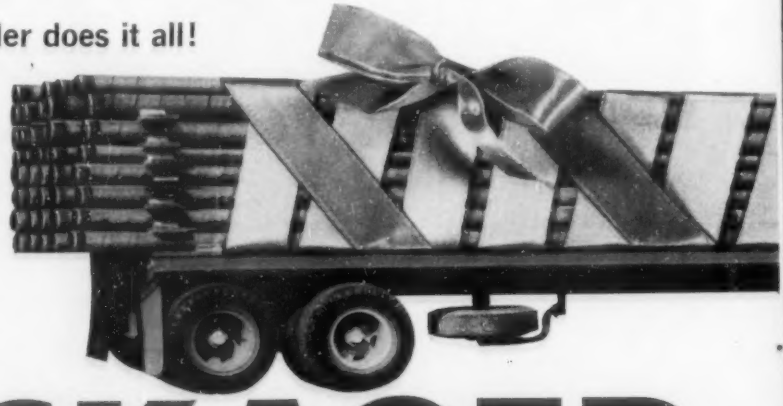
The City of Newark, N.J., is now progressing with further development of its Pequannock River Supply. Upon completion, the capacity of the supply will be increased by 9.5 mgd and the quality of the water will be improved. Works required and under construction to increase the quantity of the supply consist of: 1) The Charlotteburg Reservoir with 2.9-billion gallon capacity which involves a massive concrete gravity dam and considerable relocation activities. 2) The Farber Brook Diversion Works for diverting runoff from 3.1 square miles of the Farber Brook Drainage area. This involves a low diversion dam and a long paved channel. Works required and under construction to improve the quality of the water of the entire Pequannock Supply include: 1) Extension of the existing Pequannock Aqueduct with reinforced concrete pipe from its present terminus at the Macopin Intake Dam to the Intake at the new Charlotteburg Dam. 2) Installation of modern facilities along the extension of the Aqueduct, including a screen chamber housing traveling screens, an aerator and a new chemical building for receiving, storing and introducing chemicals required for chlorinating the supply and correcting its present corrosive characteristic. 3) Construction of diversion works to route water drawn from Echo Lake to the Charlotteburg Reservoir. Echo Lake is frequently of poorer quality than water obtained from the remainder of the watershed. It will be blended with the rest of the supply and its quality improved by natural purification processes during additional storage in the Charlotteburg Reservoir. All of these improvements are discussed in considerable detail.

"Massive Dam and Diversion Works Control Multi-Reservoir System." By H. L. Kaufman. *Water Works Engineering*, May, 1959.

Desanding Water Supplies

Hobbs, a modern city of 30,000 population, situated in the southeastern corner of New Mexico, is the center of one of the last great oil booms. In 1946 the City purchased the privately-owned water system which at that time was plagued with two major problems—inadequate facilities and considerable quantities of sand in the well water supplies. Operating under a Board of Water Commissioners, the Hobbs Water Department has expanded and improved facilities in the past ten years. Nine new deep wells have been drilled and two booster stations built. Three ground storage reservoirs with a total capacity of three million gallons and two elevated steel tanks with a combined capacity of three million gallons and two elevated steel tanks with 1½ mg storage have been constructed. Another major problem was the presence of considerable amounts of sand through the entire distribution system. Water pumped from the wells contained as much

Lower costs! One purchase order does it all!



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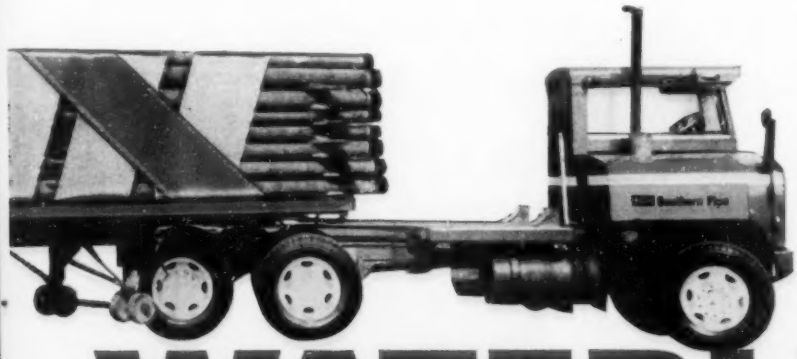
as 100 parts per million of sand, 90% of which was in the 48 to 200-mesh size range. This sand jammed rotating discs in water meters at an alarming rate. After an investigation in 1956 to determine what could be done to alleviate this problem, it was decided to test a Dorrclone Desanding unit on a trial basis, a pilot installation was erected and an extensive test program begun. On the basis of the test results, the Department ordered an additional nine systems, one for each deep well. Each unit consists of a special wet cyclone classifier, complete with underflow chamber, feed pump, piping and supports. Operating in a highly satisfactory manner for more than a year, these systems effectively eliminate influx of new sand in the system and the previous extensive flushing program has now been practically eliminated.

"Desanding Municipal Water Supplies." By M. H. Alexander. *Water and Sewage Works*, May, 1959.

Industrial Hygiene Hazards

Industrial hygiene is the engineering control of health hazards that are encountered on the job. Such hazards may be dusts, fumes, mists, gases, vapors, radiation, deleterious contacts, or other adverse physical conditions. Possible exposure to chlorine gas is, of course, the most obvious industrial hygiene hazard in water utility operation. The use of chlorine dioxide, which is more toxic than plain chlorine, and, in addition, is highly explosive in both the liquid and gaseous forms requires the use of precautionary measures in handling. Many water utilities now practice fluoridation. There is a danger in emptying the dry fluoride materials, such as, sodium fluoride, sodium silicofluoride, or potassium silicofluoride into the hopper of the dry feed machine. Experience has shown that workers, in general, are reluctant to wear respirators consistently because they are uncomfortable and cause difficulty in breathing. Some water utilities use copper sulfate for algae control. The principal hazard in handling this chemical is to prevent skin contact. Entry of the dry material into cuts or abrasions can cause slow-healing ulcers. In the past much use was made of lead and lead-containing caulking compounds for the assembly of distribution systems. Probably no great hazard was involved in such assembly. There are times, however, when large sections must be disassembled for replacement. An acetylene flame is used for speed and convenience. The flame is extremely hot, however, hot enough to convert lead or lead compounds into dense airborne fumes. In the confines of a trench, exposure to such fumes would be most dangerous. Too little attention is given to the hazards involved in entering utility pits. Serious accidents result from 1) leakage of hydrogen sulfide gas into the pit from a nearby sewer or from natural organic decomposition, 2) leakage of methane and other gases of decomposition from a nearby sewer or decomposing soil stratum, 3) leakage of natural or manufactured gases from a gas main, 4) production of carbon dioxide gas by acidic surface water in contact with a limestone stratum that displaces the oxygen in the pit. Several other hazards, including the use of toxic solvents in cleaning operations, toxic materials in paint spraying, and the formation of hazardous fumes in welding operations, etc., are discussed by the author. In order to accomplish control of such hazards, the Virginia Bureau of Industrial Hygiene maintains an impressive array of laboratory and field instruments which are used to locate, identify, and measure haz-



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SOUTHERN PIPE PACKAGED WATERLINES GIVE YOU: (1) pipe produced to your exacting specifications, (2) from steel coil in our own pipe mill, (3) cut precisely with NO random lengths ,(4) lined and coated at our plant, (5) warehoused, if necessary, until you need it, and (6) delivered to your trenchsite ready for placing in trench. **PACKAGED WATERLINES** from our warehouse stock of standard sizes are also available for immediate delivery.

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P.O. BOX C • AZUSA, CALIFORNIA • CUmberland 3-7111 – EDgewood 7-1221

ards of all sorts. When a potential hazard to health is found, an attempt is made to reduce or eliminate it.

"Industrial Hygiene Hazards in the Water Supply Field." By Richard H. Mansur. *Jour. A.W.W.A.*, May, 1959.

Performance Characteristics

Seldom is there a pump in the possession of a user where both the pump and driver nameplates have disappeared, no record of the purchase of the pump is available, and the only thing certain for determining its performance characteristics is the physical presence of the pump itself. Nevertheless, if this should happen, it is still possible to carry out certain measurements and calculations to obtain the desired information with some degree of accuracy. There are two separate phases to the problem of estimating the performance of a centrifugal pump of which one knows nothing except the physical dimensions and proportions. The first phase is the theoretical aspect of the problem which would give us a reasonable approximation of the pump head-capacity curve at any given operating speed and the expected power consumption of the pump. The second phase of the problem concerns the practical aspects of the application of the pump to a particular service. By means of a sample calculation the author has shown the procedure for approximating the performance characteristics and determining the power requirements and safe operating pressures of a centrifugal pump from its physical measurements. Nevertheless, this should be resorted to only in the absence of a more reliable method and certainly should be used with caution.

"What Are the Characteristics of the Unknown Pump?" By Igor J. Karassik. PUBLIC WORKS, June, 1959.

Radioactivity and Water

This article is a comprehensive discussion of ionizing radiation, its known somatic and genetic effects on the human population at the higher dosages and its probable effects at minute levels of radiation. The sources of radiation, both natural and artificial, are discussed in some detail, the natural or background radiation being that which is normally present in the environment in which we live and over which we have little or no control. The amount of radioactive material normally present in water supplies is nil. These supplies, however, may become contaminated during wartime either from the discharge of a nuclear weapon in the source of supply or from fallout resulting from the explosion. In peacetime radioactive material may get into water supplies through the discharge of wastes from nuclear sources, through an accident or through a mechanical or human failure. The author concludes this article with a discussion of the means of protection of our municipal water supplies during time of peace and war.

"Radioactivite et Eau Potable." By Dr. A. Lafontaine. *La Technique de L'Eau*, Avril, 1959.

Other Articles

"Legal Aspects of Municipal Water Supply in The Pacific Northwest." Legal problems and responsibilities that merit the attention and careful consideration of all administrators of municipal water systems. By Ernest H. Campbell. Jour. A.W.W.A., May, 1959.

"Sanitary Engineering Appraisal of **Waste Water Reuse.**" This article sum-

Crystal-pure water
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with Dicalite
Compared with sand filtration systems, diatomite filtration of municipal water supply with Dicalite Filteraids starts you out thousands of dollars ahead. And the records of municipalities now using Dicalite filtration prove that clarity and purity are at least equal to the best that sand can do. Health department records also verify this.
Cost savings start with the smaller space requirements of a filter system using Dicalite – no more than a quarter of the space needed for a sand system of comparable capacity. Make your own estimates of what this could save you in land and building costs.
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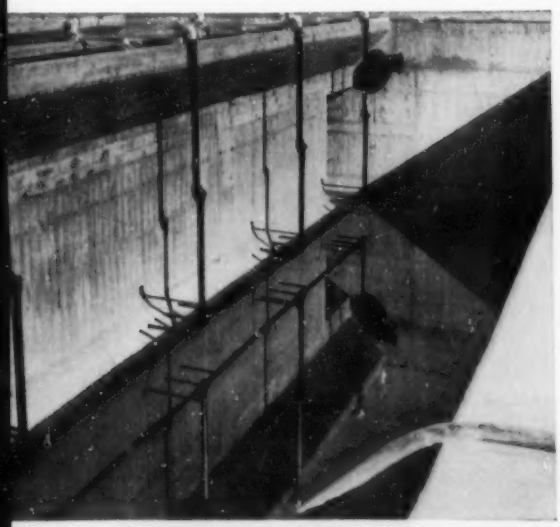
The Columbus, Ohio, Sewage Treatment Plant relies on wrought iron pipe's protective properties in tough, corrosive service

21 years in other corrosive services here support wrought iron again for new plant addition



View of wrought iron air diffuser piping in Columbus, Ohio's Sewage Treatment Plant

Wrought iron served so well, so long in corrosive services at the Columbus, Ohio Sewage Treatment Plant that engineers selected wrought iron again for use in the plant's new $2,500,000 addition.

On the job in the original plant for 21 years, wrought iron was used for all pipe services two inches and under. In the new addition, 90% of the wrought iron used was for guard railings 1½ inches in diameter. The remainder went into gas lines and miscellaneous piping, including the grease ejector mechanism vault and air diffuser piping.

AND NEW 4-D WROUGHT IRON LASTS EVEN LONGER

Today, specifiers and plant operating men are getting a wrought iron that is the most versatile material yet developed to help fight corrosion. New 4-D Wrought Iron faces corrosive attack with far greater resistance, even, than standard wrought iron.

It is available now from your distributor. Ask him about it. And write our Engineering Service Department for answers to specific piping problems. New 4-D Wrought Iron literature available upon request. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

City of Columbus Sewage Treatment Plant Addition
Engineers: Uhlmann & Associates
Contractors: George S. Sheaf & Co., Inc. and E. P. Coady & Co. (A Joint Venture)
Fabricator: Columbus Metalcraft Co.

BYERS 4-D WROUGHT IRON

TUBULAR AND FLAT ROLLED PRODUCTS

marizes the historical development of waste water reclamation, describes ways in which waste water may be utilized, and discusses the engineering, public health, economic, legal, and aesthetic problems that must be faced in reclamation of waste waters. By H. J. Ongerth and J. A. Harmon. Jour. A.W.W.A., May, 1959.

"Wastewater Technology in Germany." Part II. In this second part of a two-part article on recent progress in sewage treatment technics in Germany, the author discusses secondary treatment and sludge digestion. By Dr. Ing. H. Rhode. Water and Sewage Works, May, 1959.

"Water Softening." Part 3—Cation Exchange. The forty-fourth of a series on water works practices. By George E. Symons. Water and Sewage Works, May, 1959.

"Traitement de L'Eau par Storage, Coagulation et Decantation." Rapport national francais au Congres de Bruxelles (1958) de l' Association Internationale des Distributions d'Eau. Chapitre II. La Decantation des Eaux floculees. par M. P. Blanchard. Techniques et Sciences Municipales, Mars, 1959.

• • •

Indiana Flood Control District

Chapter 233 of the 1959 Acts of the Indiana Legislature provides for the formation of special flood control districts where necessary for the protection from floods, or the hazards thereof, or by floods caused by storm water drainage. The district may include all or any part within the corporate limits and all or any part of contiguous territory within a distance of four miles. Such necessity shall be based on floods within the preceding ten-year period.

When 25 percent of the territory within the corporate limits of the petitioning city or any included town has been inundated by flood or storm waters then all the territory within the corporate limits shall be presumed to be specially benefited except such territory which is subject to inundation but which will not be protected by control works. No territory outside the corporate limits of cities or towns with an elevation three feet above the highest 10-year flood stage shall be included except that protected by flood control works.

All property within a district shall be subject to a special benefit tax. Bonds issued for construction of control works may not exceed 5 percent interest. Bonds may not be issued in excess of 5 percent of the assessed valuation of the property within the district.

For the purpose of operation, maintenance and repair of control works, a special tax may be levied not to exceed 25 cents on each $100.00 of taxable property. The term "works" shall include main storm sewers, pumping stations, storm water ditches, channels and culverts.

• • •

Experiences With Microstraining at Winnipeg

In the annual report for 1958, the Greater Winnipeg Water District, N. S. Bubbis, General Manager, reported on its experiences with a microstrainer. For a period of about two and a half months the District had on loan from Glenfield & Kennedy Ltd., Glasgow, a pilot microstraining plant. Tests were carried out on the efficacy of this process in removing algae and other organisms from Shoal Lake water. The pilot plant was a self-contained unit about 4½ ft. in height and width and 8 ft. long, consisting of a steel tank containing a revolving drum screen of extremely fine, closely woven stainless steel wire. The process is continuous, with raw water being admitted at one end to pass through the revolving drum and out through an overflow pipe at the other end.

Synchro-Start's new protective engine controls have been designed, for the starting and stopping of engines from remote pilot devices, such as pressure switches, float switches, power failure relays, etc., and are completely automatic in operation. These dependable controls are encased in a steel, dust proof cabinet, and now feature enclosed PLUG-IN RELAYS as well as OVERLOAD BREAKERS. The plug-in relays simplify what little field maintenance that may have been required in older models, while the overload breakers eliminate the necessity of replacing fuses.

In designing this unit we have used the same high quality materials and workmanship that our customers have come to expect throughout Synchro-Start's 27 years of manufacturing engine controls.

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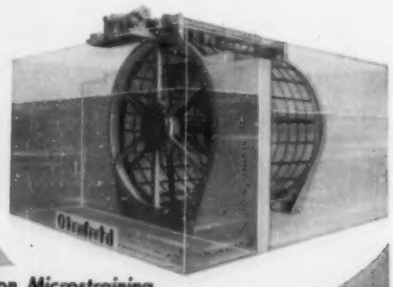
Automatic Water Filtration

. . . the Glenfield MICROSTRAINER® is the most unique advance in water filtration. Here are some of the major advantages:

low initial cost • high filtration efficiency • automatic and continuous operation under open gravity conditions • small head loss, eliminating pumping



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Rubber Seated BUTTERFLY VALVES

- **Low Initial Investment!**
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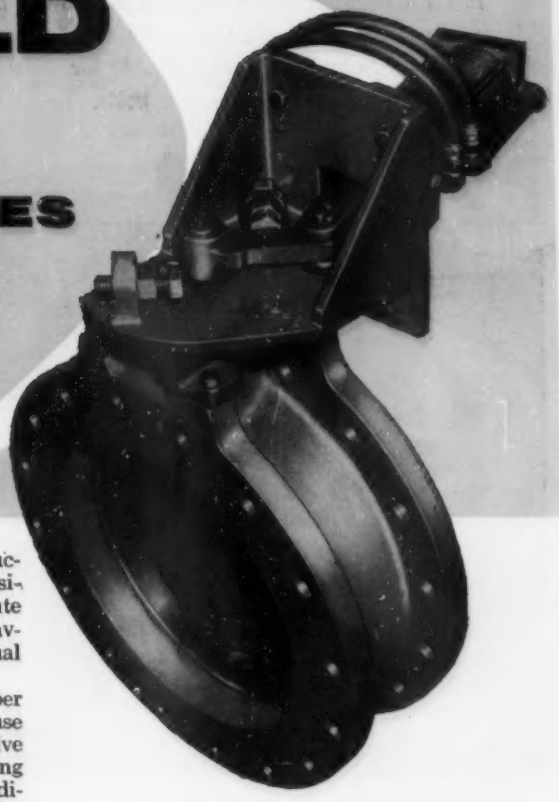


Offering new, improved features plus simplified construction, Leopold Rubber Seated Butterfly Valves provide positive drop-tight operation year after year, with an absolute minimum of upkeep. They're built for maximum space savings and may be mounted in any position to suit individual conditions.

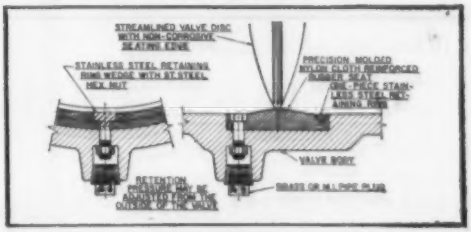
In this advanced design, a unique valve disc and rubber seat arrangement at the disc hub eliminates the major cause of premature seat failure. Only one moving part (valve disc) is in contact with the flowing medium, thus reducing wear and lowering the required operating torque. In addition, every Leopold Valve has a rugged flanged valve body, precision molded resilient rubber or synthetic seat, and heavy-duty corrosion-resistant operating parts.

Built in accordance with applicable AWWA specifications, Leopold Standard Butterfly Valves are available for line sizes 4"—48", with a choice of manual or various types of automatic operators.

For special control applications, LEOPOLD is equipped to furnish a specially designed, shop-tested, control package, which offers the advantage of full responsibility for the entire control system by a single reliable manufacturer.

NEW, EXCLUSIVE "UNI-WEDGE" SEAT RETENTION

This unique construction allows seat retaining pressure to be adjusted externally with the valve in place in the pipe line. Only two seat retaining screws are utilized which are not in contact with the flowing medium, minimizing erosion and corrosion of the seat retaining mechanism. Eliminates the need for numerous small seat retaining screws inherent in most available valve designs.


STREAMLINED VALVE DISC WITH NON-CORROSIVE SEATING EDGE
STAINLESS STEEL RETAINING RING WEDGE WITH ST. STEEL HEX. NUT
PRECISION MOLDED NYLON CLOTH REINFORCED RUBBER SEAT
ONE PIECE STAINLESS STEEL RETAINING RING
VALVE BODY
RETENTION PRESSURE MAY BE ADJUSTED FROM THE OUTSIDE OF THE VALVE

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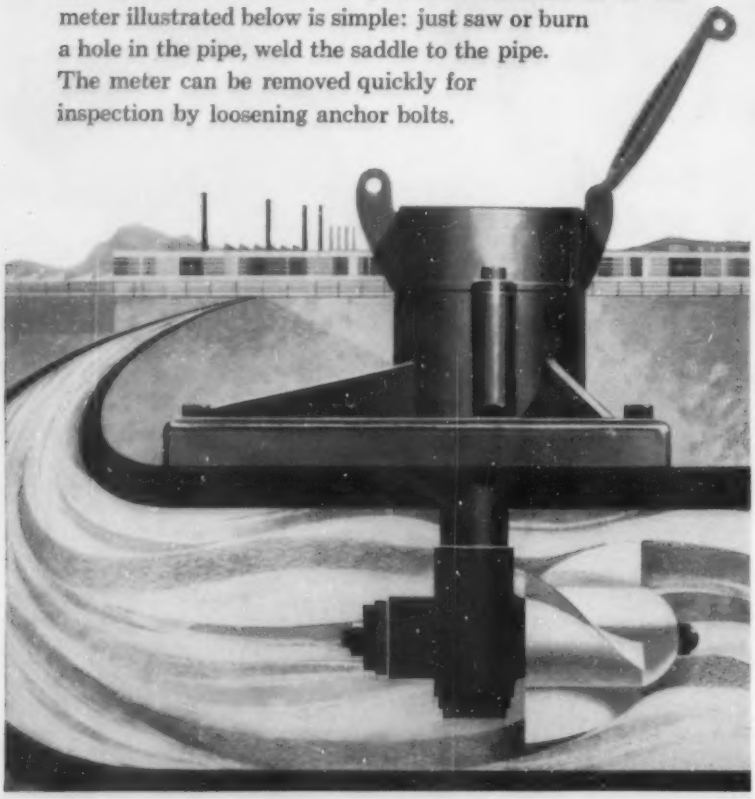
Increase efficiency and water profits with

MEASURE-RITE propeller meters

Measure-Rite meters can be installed on new or existing lines . . . for accurate, dependable water metering control.

They will register accurately whether mounted in horizontal, vertical or *inclined* positions. Installation of the meter illustrated below is simple: just saw or burn a hole in the pipe, weld the saddle to the pipe. The meter can be removed quickly for inspection by loosening anchor bolts.



Free flow design
assures low loss of head

In the Measure-Rite assembly, the propeller is positioned *forward*, fully centered in the metering chamber for greater metering accuracy. Free flow design provides least restriction of flow — minimizing loss of head.

Send for Bulletin MR-105 describing the complete line of Measure-Rite propeller meters. Address inquiries to:

MEASURE RITE, INCORPORATED

A Subsidiary of BADGER METER MFG. CO.
4545 W. BROWN DEER RD. • MILWAUKEE 18, WISC.

The screen is continuously washed with screened water, the head loss through the unit being about 6 ins.

The unit was initially set up in the City of Winnipeg James Avenue Pumping Station and placed in operation on June 27th, 1958. About 50 to 100 gallons per minute were passed through the unit continuously. Plankton counts were taken twice each day of the raw and of the filtered water. Reductions in total Plankton count ranged from 50 to 80 percent. As the water being screened at the high pressure plant contained chlorine, the unit was relocated to the District's Booster Pumping Station so that results on unchlorinated water could be obtained. Tests were continued until September 12th, 1958 when the machine had to be returned to the manufacturer. Results at the Booster Station were equally as good as those obtained at the James Avenue Station.

The tests proved that microstraining was one possible method of effecting a substantial reduction in Plankton count in Shoal Lake water, should this treatment ever be required in the future.

Aquatic Weed Control

The direct 2,4-D treatment in 1957 of aquatic weeds exposed by lowering of the water level in Newburgh and Phoenix Lakes, Wayne County, Mich., was only partially successful. Certain species were eliminated, but surviving species again appeared in dense masses in 1958. The abundant weed growth in Newburgh Lake was treated in the summer of 1958 with a 40 percent solution of sodium arsenite. The spray was applied evenly over the surface of approximately 6 acres of water in quantities calculated to form a solution with the water of 10 parts of sodium arsenite to one million parts of water. The known depth of the water was the principal factor in the calculation. In this treatment, 220 gallons of sodium arsenite were used. Aquatic-weed control results were fair.

Grants-in-Aid by States for Sewage Treatment

A measure introduced into the North Carolina legislature would create a revolving fund of $2.5 million for long-term loans to aid cities and villages build sewage treatment plants. Pennsylvania is also considering a bill for state grants of $2 million annually for aiding in sewage treatment plant construction.

filter performance with PALMER FILTER BED AGITATORS

The Palmer Filter Bed Agitator is a simple and inexpensive device that is being incorporated in new and existing plants to increase the filtration capacity and eliminate mud balls.

TECHNICAL ADVANTAGES

- 1—Requires an average of 40% less wash water
- 2—Completely eliminates mud balls
- 3—Eliminates cracking or shrinking of the beds
- 4—Produces "new" filter media after short period of normal operation
- 5—Turns out purer, better tasting water
- 6—Low installation cost
- 7—Low operating cost
- 8—More water through the filters
- 9—Less "time out" washing filters

The Palmer Filter Bed Agitator is covered by U. S. Patents 2309168 and 2309017.

ENGINEERING FACTS

CONSTRUCTION—The Palmer Filter Bed Agitator is constructed of brass and bronze throughout. Nozzles can be removed easily from the agitator arm.

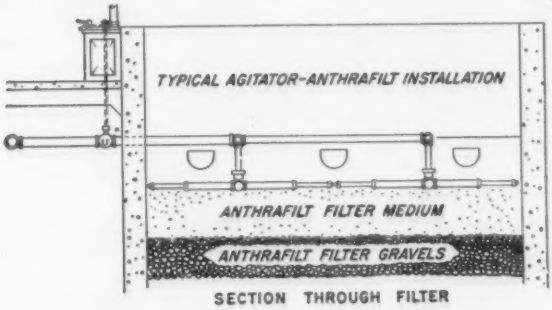
SIZES—Palmer Agitators are adaptable to any size or type of filter. Available in lengths up to 15'.

WATER REQUIRED—The Palmer Agitator operates with low volume at high velocity. Usually, a delivery of ½ g.p.m. per square foot of filter bed is ample.

PRESSURE REQUIRED—40 lbs. and upwards.

R.P.M.—The speed of the Agitator varies from seven to eighteen r.p.m.

SIMPLICITY—Simple to install, easily observed and inspected.



SECTION THROUGH FILTER

The Palmer Agitator consists of a horizontal bronze arm suspended just above the surface of the Anthrafilt or sand. The agitator arm contains jet nozzles through which water is forced at extremely high velocity. The jets are pointed downward to penetrate the filter media before the wash water is turned on. This penetration breaks up the surface of the filter bed while the agitator revolves slowly, propelled by the velocity of the water through the jets. Thus, the media is in a fluid condition and free from encrusted deposits when the wash water is turned on. When the wash water reaches the level of the agitator arm, the tremendous velocity of the jets causes violent turbulence while the upper strata of the sand or Anthrafilt is expanded. The Palmer Agitator remains in action until shortly before stopping the filter wash.

Ask any user. Write us for list of installations and for descriptive bulletins.

IMPROVE FILTRATION . . . EFFECT ECONOMIES WITH . . .

Anthrafilt

(Trade Mark Reg. U. S. Pat. Off.)

Anthrafilt is SELECTED Pennsylvania anthracite, crushed, cleaned, screened and graded to required sizes. It increases the length of filter runs. Requires half the backwash water used for sand; reduces algae troubles to a minimum; is insoluble in acids or alkalies; permits higher filter rates and increases average plant capacity 50%; and there is less coating with inorganic salts. The cost of Anthrafilt is low. We invite technical enquiries.

OVER 200 UNITS IN OPERATION

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FILTER EQUIPMENT Company

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In 1859
HERSEY
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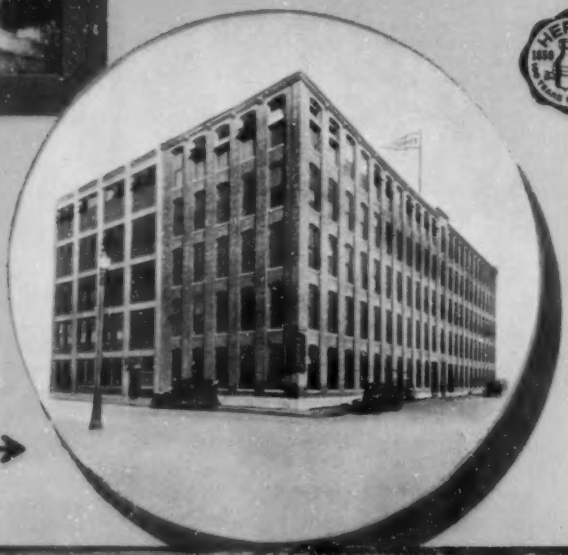

And in 1957
The Increased
Demand for
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Water Meters
necessitated
the Building and
Occupancy of
this New and
Modern Plant at
Dedham, Mass

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Your Best Buy For All Types of Services

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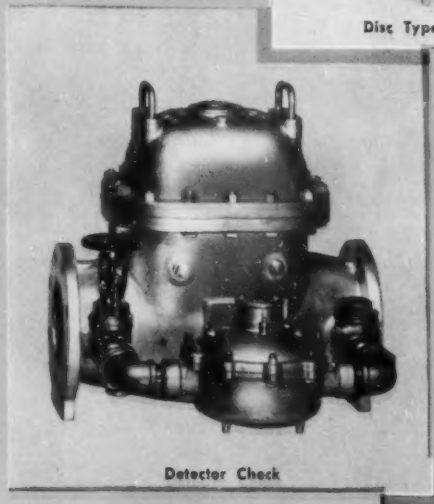
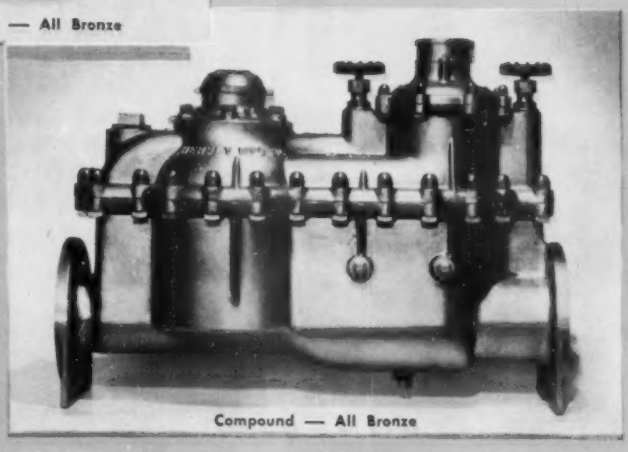
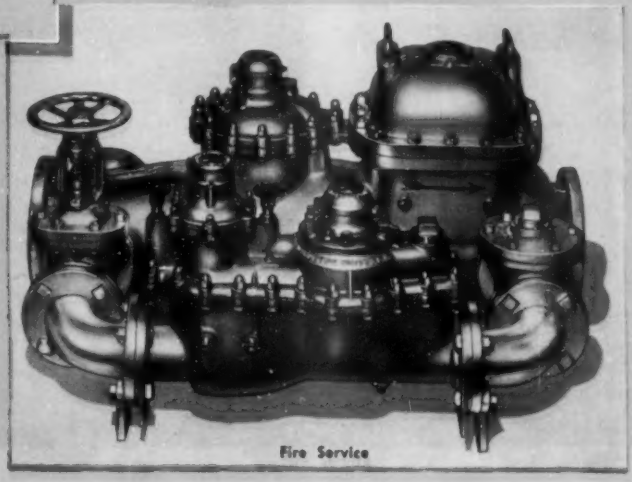
Disc Type — All Bronze



Detector Check



Compound — All Bronze



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"You can't buy a better water meter than HERSEY"

IN WASHINGTON STATE...
OVERLAID FIR
DUPONT
FT. LEWIS
NEXT RIGHT
1/2 MILE
WASHINGTON STATE HIGHWAY DEPARTMENT
TRAFFIC ENGINEER Rex G. Still
SIGN ENGINEER Alan L. Solberg

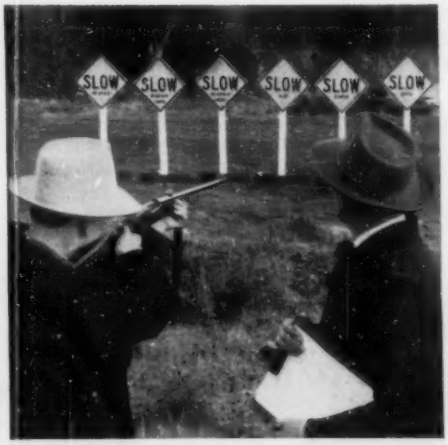
PLYWOOD SIGNS SHOW THE WAY

WASHINGTON STATE highway officials guide motorists with modern color-coded reflectorized signs of overlaid fir plywood. And because they cost less and last longer than metal signs, they mean important savings for taxpayers, too.

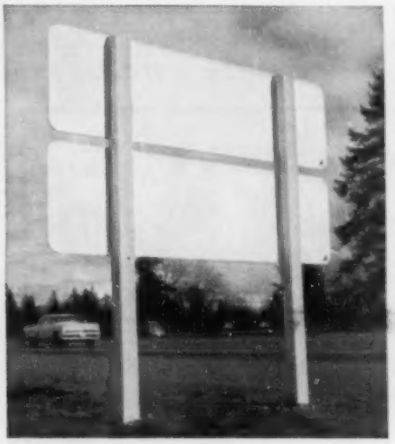
The state has standardized on High Density overlaid plywood for all large directional and informational signs. Reflective sheeting is applied direct, without prime coats. This elimination of painting saves money and the plastic-like high density overlay provides a better and more foolproof bond for the reflective sheeting. Backs are painted only where special colors are required.

For smaller warning and regulatory signs, Washington uses both High and Medium Density overlays. In the case of Medium Density, panels are primed before reflectorizing.

Washington has found that overlaid plywood signs stand up better under severe weathering and accidental or deliberate abuse. There is no rust, corrosion or other progressive deterioration after damage. Plywood signs are stronger and stiffer, too, and require fewer posts and framing members. Panels are light and easy to handle.



Vandalism tests conducted by Douglas Fir Plywood Association show plywood signs far stronger and more durable than steel or aluminum. Bullet holes, for example, are clean, sharply defined, with limited impact area. Write for test report.



Strength and stiffness mean larger size (up to 4′ x 8′) plywood signs can be installed without backing or framing. On king-size shoulder mounted or overhead signs, supporting framework is greatly simplified. Panels are light, easy to handle.

Durable overlay eliminates checking, grain raise. High Density overlay needs no paint protection; reflective sheeting may be applied direct. Medium Density is for plain painted signs. Base panel is waterproof Exterior (EXT-DFPA®) plywood.

FOR MORE INFORMATION (detailed specifications, application data, etc.) write to:

DOUGLAS FIR PLYWOOD ASSOCIATION
TACOMA 2, WASHINGTON
—a non-profit industry organization devoted to research, promotion and quality control

DFPA TESTED QUALITY

THE HIGHWAY AND AIRPORT DIGEST

Prepared by **FRANK FORCE,** *Associate Editor*

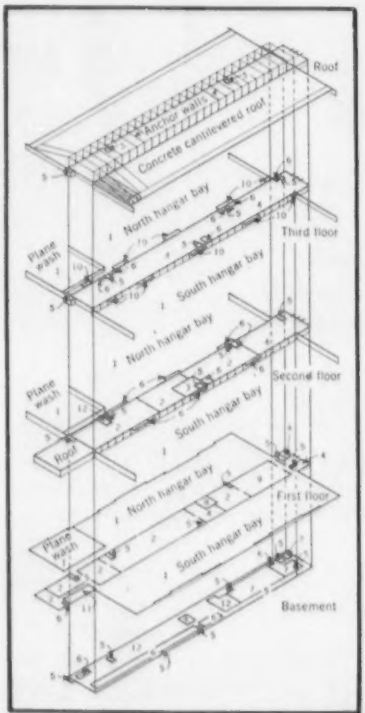
New Headquarters for Highway Personnel

Headquarters for the Wyoming Highway Dept. is a modern building in northwest Cheyenne. The office building and the adjoining materials testing laboratory are on a 37½-acre tract with the main building containing 90,200 sq. ft. of floor space and the laboratory more than 14,000 sq. ft. A Highway Building Authority was formed to coordinate various planning details and consider the problem of financing. It was decided to finance the project by borrowing the necessary money from obligated highway construction funds and repaying the amount as monthly depreciation as it was charged against the buildings. The main building surrounds a central courtyard; it can be easily expanded and is air conditioned throughout. Metal partitions in both buildings can be rearranged to meet future space requirements and both are primarily heated by low-pressure, radiant hot-water systems. A cafeteria and auditorium are included in the building. Nearly 200 engineers, technicians and clerical personnel are employed in the 2 buildings and an employee parking lot provides for 250 cars.

"Wyoming Highway Personnel Move Into Handsome New Headquarters." *Better Roads*, April, 1959.

Design and Construction of Airports and Airfields

This group of articles covers the important part the civil engineer plays in the design and construction of airports and airfields to accommodate the large and heavy jet planes now coming into use. The articles are as follows: "Better Airfields for Bigger Aircraft," by John M. Kyle, Jr., Chairman, Executive Committee, Air Transport Div., Chief Engineer, Port of New York Authority, New York City; "Airport Master Planning for the Jet Age," by G. C. Miller, Airways Engineer, Thomas B. Bourne Associates, Inc., Washington, D. C.; "Concrete Pavement for Jet Aircraft," by Gordon K. Ray, Manager, Highways and Municipal Bureau, Portland Cement Association; "Federal Participation in Airport Development—the Role of FAA," by E. R. Quesada, Administrator, Federal Aviation Agency; "Washington International Airport—a Model for the Jet Age," by Herbert H. Howell, Director, Washington Airport Project, Federal Aviation Agency; "Pavement for Heavy Planes," by Philip A. Hahn, Chief, Washington International Airport Div., FAA; "Heliport Framing Halved By ASCE Developed Criteria;" "Tar Resurfacing for a Jet Airfield," by Charles J. Carter, Airport Engineer, Wheeling - Ohio County Airport, Wheeling, W. Va.; "Airport Fueling Systems for Jets," by James P. O'Donnell, Consulting Engineer, N. Y., N. Y.; "Planning Hangars for Jet Aircraft," by Boyd G. Anderson, Partner, Ammann & Whitney, Consulting Engineers, N. Y., N. Y.; "Planning Airport Terminal Buildings," by Thomas M. Sullivan, Deputy Director, Aviation Dept., The Port of New York Authority; "Asphalt Pavement Proved for Jets by Columbus AFB Test," by Arvin S. Wellborn, Chief Engineer, The Asphalt Institute. *Civil Engineering*, May, 1959.



Courtesy Civil Engrg.

● **JET-TYPE maintenance hangars provide a total area of 500,000 square ft.**

Computer Program for Grading Design Data

An electronic computer is giving answers in hours that used to take weeks in reducing field survey data to design information for the North Dakota State highway department. The equipment is a Royal Precision LGP-30 digital computer. It takes 20 to 30 seconds to read the field notes into the computer, 20 to 25 seconds on computation and 20 to 25 seconds to print out the results. As a result it is possible to design 3 to 8 miles of highway per working day which is about 16 times as fast as it can be done by hand. The large memory in the unit makes this computer suited for long problems. The longest problem is the cut and fill and this problem contains 2000 instructions plus various design constants. The total problem can be stored in about 75 percent of the available storage space on the drum, leaving the other 25 percent of the space for the majority of the other type problems. The first step in utilizing the computer in solving a specific problem is to construct a flow chart or a block diagram showing the flow of data through the logical steps the computer must follow to obtain the desired result. The program is then completed by writing down the commands the com-

The Town of Babylon, N. Y., has grown from a population of 40,000 in 1940 to more than 115,000 today. Cat Motor Graders have proved mainstays of economical operation building new streets, as well as resurfacing and maintaining existing streets.

"OUR NO. 12 WITH PRECO AUTOMATIC BLADE CONTROL CUTS GRADING TIME IN HALF—AND THAT'S NOT ALL!"

Charles Vogel, Supt. of Highways, Town of Babylon, Lindenhurst, N. Y.

HERE ARE FACTS, straight from Mr. Vogel: "The Preco attachment on our Cat No. 12 Motor Grader cuts grading time in half, saves many man-hours checking and staking grades and enables us to use less experienced operators on fine grading. It paid for itself in one season!

"One example of its value is its work on our Herzel Blvd. The S. E. section is 4,100′ long. We built it 50′ wide with an 8″ crown. Two motor graders without Preco took 5 days to bring it to instrument-checked specifications. It had to be 'shot' every day and 100 markers were needed as guides.

"The N. E. section is 2,300′ long, 50′ wide, 8″ crown. The Preco attachment on the No. 12 enabled us to complete the grading—instrument-checked—in less than a day and held the grade to within ½″. The Preco Automatic Blade Control is a timesaver and a material saver. On another job we saved 51 truckloads of material on one S-curve."

Here are more facts from Frederick Wendell, Construction Foreman: "The No. 12 is a money saver because of its low down time, economical operation and easy maintenance. The Preco attachment is excellent. It combines two jobs for us. It helps survey by determining low spots and fine-finishes the grade quickly and accurately."

With Preco, optional on the No. 12, the operator selects the desired slope on a dial, and the unit automatically maintains blade slope within ⅛″ in 10′. A Caterpillar exclusive, the Preco Control is now transistorized for more freedom from maintenance and adjustment. Nothing can match it for fast, economical grading. Job after job proves this. For complete facts, see your Caterpillar Dealer.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

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BEST BUY FOR YOUR TAX DOLLARS

puter can follow to obtain what is called for in each block in the flow chart. This one continuous program is written for either single or divided lane highways with individual grade lines.

"One Computer Program Gives All Grading Answers." *Roads and Streets*, May, 1959.

Utilities in Highway Construction

The Utilities Division of the Delaware State Highway Dept. was organized to handle liaison with utilities and to coordinate plans and field problems from program through construction stages. Headed by the state utilities engineer, it is staffed by division utilities coordinators, whose duties and responsibilities are as follows: a) Handling liaison between the various Highway Dept. divisions and the various utility companies; b) coordinating the planning, investigation and prosecution of all utility operations; c) developing cooperation between all parties involved in accomplishing required utility adjustments; d) aiding the various utilities in their planning and scheduling; e) determining and approving the extent, nature and cost of all utility work; and f) developing policies and procedures with approval of the Chief Engineer, for the proper control and handling of utility operations on State Highways. In a typical construction project, the job was broken down into three successive sections. Six stages of work were defined within each section, and the traffic maintenance requirements given. The stages were: a) Breaking up and removal of existing pavement and curbs, two lanes at a time; b) alterations and additions to utility facilities; c) construction and repair of drainage facilities; d) excavation to sub-grade; e) setting of forms, fine grading and paving; and f) curbs, sidewalks and other construction in back of curbs.

"Utilities: What Can Be Done About Them?" By E. Powell Smith, Utilities Engineer, Delaware State Highway Dept. PUBLIC WORKS, June, 1959.

Urban Street Construction and Maintenance

The Town of Hempstead, N. Y., has a population of 700,000 and its problems are all urban in nature and are complicated by the large area involved, the interference of numerous incorporated villages within the town's confines, and the need to correlate the work with numerous other governmental bodies. The highway department engineer and the consulting firm of Lockwood, Kessler & Bartlett, Inc., review all the proposed permanent projects, decide what is to be done, assign priorities and submit their recommendations. All work done by the town forces is on a priority basis which eliminates a concentration of work in some areas or the exclusion of work in others. A subdivision control ordinance requires that subdividers provide within their area paved streets, curbs and gutters, storm water drainage systems and similar facilities. In the last 12 years, there have been 200 new residents added each day. Also, 40 new structures are erected each day. Last year town forces used 36,000 tons of stone, 30,000 cu. yds. of cinders for base stabilization, and 1¼ million gallons of liquid materials such as road oils, emulsions, cut backs, etc. For 1959, the budget for contract work is in excess of $4 million. The town owns over 200 pieces of equipment and in addition rents around 90 trucks on a daily basis for work in the various areas. A 10-hour Supervisory Relations course, consisting of five 2-hour evening courses, has been held using the case-study method and was aimed at improving relations between key

HAVE YOU STOPPED TO THINK
ABOUT SAFETY IN SIGNS?
Signs made to control traffic have to be seen and read – day in, day out, year after year. That's why you're safe when you install Miro-Flex signs. They are embossed for greater strength, rigidity, and legibility. Because they are made on zinc-coated, Bonderized steel, and finished with high-grade, baked-on enamel, they still do their duty years after ordinary signs have been replaced. A complete line of Uniform Traffic-Control Signs, Street-Name Assemblies, and custom-designed signs are available. Write for free catalog.
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SPEED LIMIT 55
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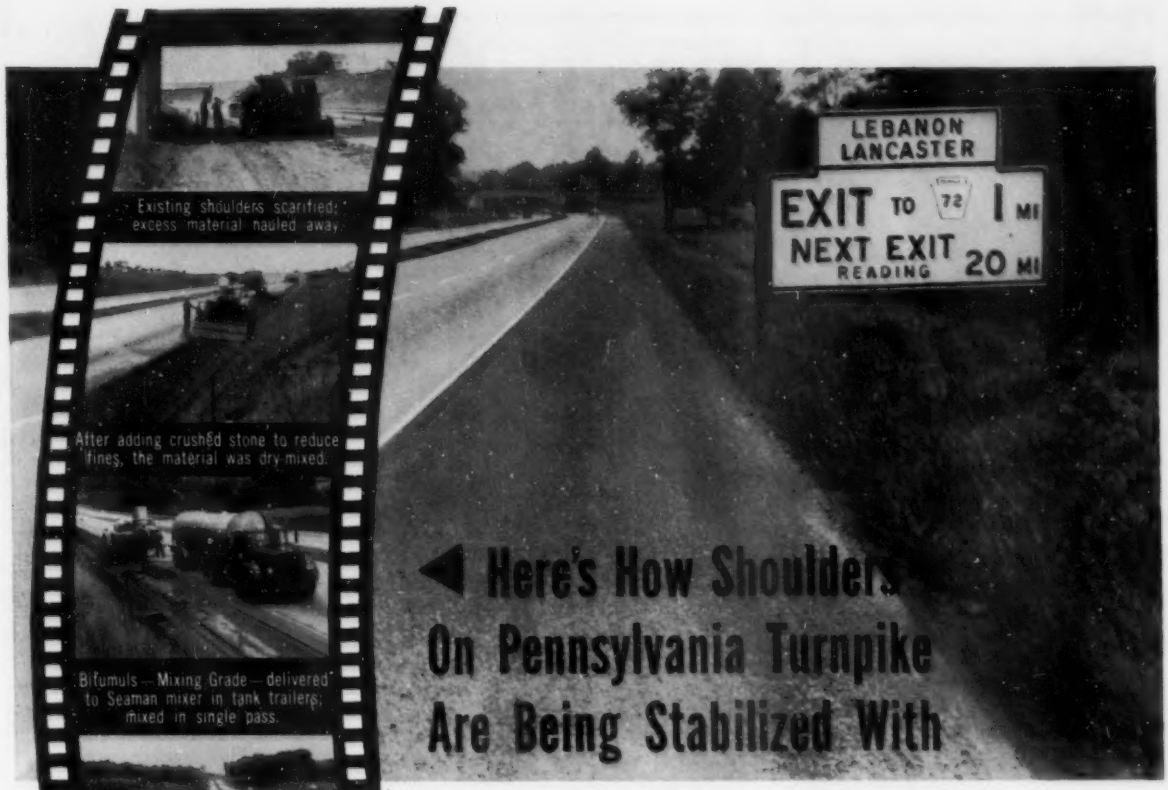
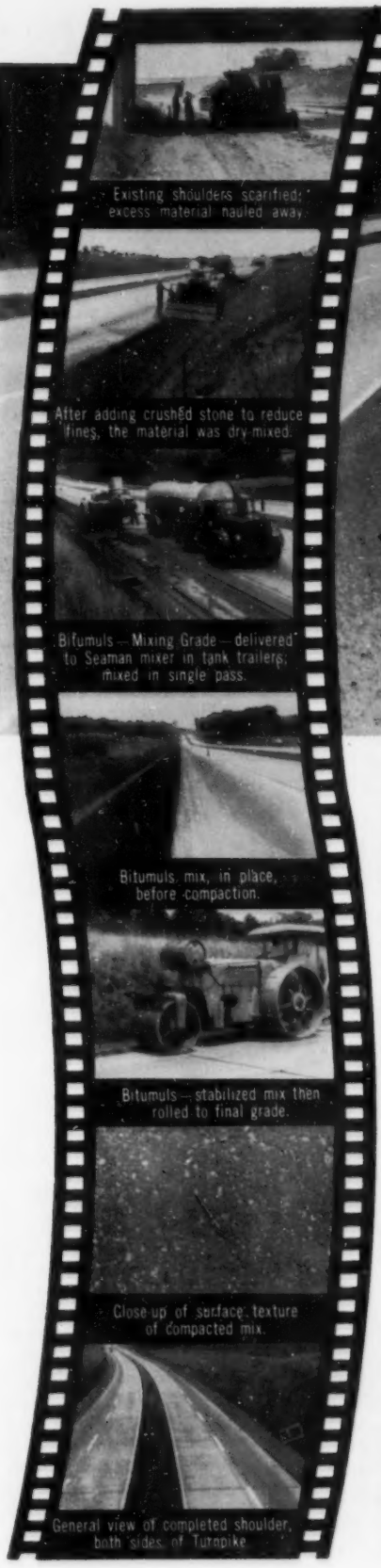


◀ Here's How Shoulders On Pennsylvania Turnpike Are Being Stabilized With

BITUMULS


Existing shoulders scarified; excess material hauled away.
After adding crushed stone to reduce fines, the material was dry mixed.
Bitumuls—Mixing Grade—delivered to Seaman mixer in tank trailers; mixed in single pass.
Bitumuls mix, in place, before compaction.
Bitumuls—stabilized mix then rolled to final grade.
Close-up of surface texture of compacted mix.
General view of completed shoulder, both sides of Turnpike

Proved best by comparative test, Bitumuls emulsified asphalt is now being used to stabilize most of the 132 miles of 8-foot shoulder along the Pennsylvania Turnpike.

The original untreated shoulders were inadequate. In 1955, engineers of the Turnpike Maintenance Materials Department, working with Michael Baker, Inc., of Rochester, Penna., (consulting engineers) took samples and ran tests. Based on their findings, various methods and materials were specified for test-sections of replacement shoulders in 1956.

Test Results:

After a winter of service, the test sections were checked and evaluated early in 1957. The Bitumuls stabilized section had performed best, and was specified for the job.

Bitumuls shoulder stabilization is fast and economical (see left). The untreated shoulders are scarified; some material is removed. Crushed stone is added to reduce the fines content, and the material is dry-mixed in place.

Bitumuls delivered by tank-trailer, is pumped, cold, through the mixer. In a single pass the material is mixed and laid, ready for rolling.

Work on the Turnpike shoulders started in 1957 from Mile Post 230 (Gettysburg Interchange) and will be completed in 1959 at Mile Post 296 (Morgantown Interchange).

The size and importance of this Turnpike job sharply underscores one point: Bitumuls provides adequate stability for long-lasting, heavy duty shoulders at low cost!

Call our nearest office for additional information.

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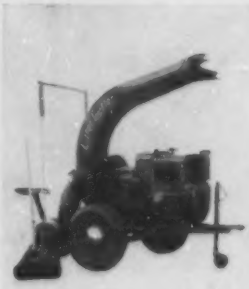
TARCO "Litter-Getters" for LEAVES and LITTER



Tarco "Litter-Getters" are **powerful, vacuum type machines . . . uniquely flexible** and carefully designed for the collection of **Leaves** and **Litter:** newspapers, paper cups and wrappings, tin cans, pop bottles, ticket stubs, etc.

Municipal Uses: Collecting leaves at the **rate of 1 cubic yard per minute.** Picking up general light, bulky litter . . . in **street gutters, around public buildings, parking lots, parks** and **playgrounds.** Can be used for ventilating underground sewer repair work.

Trailer Mounted "Litter-Getters" can be used with any one of seven different suction assemblies. Skid mounted units for dump body mounting with two different suction assemblies.

"Litter-Getters" are **lower in initial cost.** Are **simple to service** and **easy to operate. Much more flexible** . . . collection from either side. See your nearest Tarco Dealer or write us for complete details.

TARRANT MFG. COMPANY
28 Jumel Place, Saratoga Springs, N.Y.

COMPACT, POWER-PACKED ACKER TEREDO CORE DRILLS

SPEEDS SOIL SAMPLING

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- Penetration Testing
- Permeability Testing
- Wash Boring
- Driving Casing
- Rock Coring and many more!

Whatever the sampling technique, the Acker Teredo is up to it! Its modern design and host of useful features makes the Teredo the most useful you can buy!

It's ruggedly built, yet compact and light enough to be completely portable. Mount it on skid base, truck or trailer and power it with gasoline, diesel, electric or air motor. It's easy to use — inexpensive to operate!

Write today for Bulletin 30-R. - PW

ACKER DRILL CO., Inc. P.O. Box 830 Scranton 2, Pa.

Over 40 years of experience manufacturing a complete line of diamond and shot core drills, accessories and equipment.

personnel in the Highway Dept. and its 400-man operating force.

"They Are Not 'Highways' At All." By Harold Haff, Supt. of Highways, Town of Hempstead, N. Y. *The American City,* May, 1959.

A State Looks To Its Highways

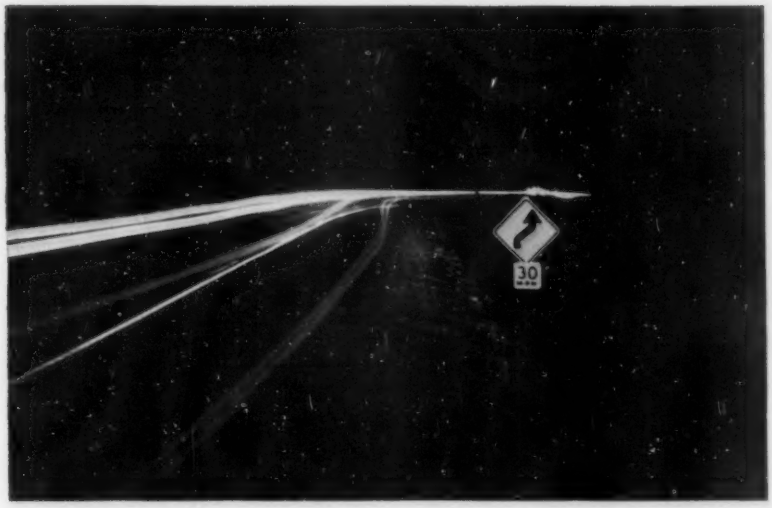
Following a comprehensive master plan conceived to satisfy growth potential over the next 20 years, the State of New Hampshire is building a network of roads and highways that may soon become as strong an attraction as its scenery, its low taxes and its rural atmosphere. The ultimate objective of the state is a four-lane, limited-access, high-speed interstate highway that will bisect the state, with trunk lines and bypass roads to carry the feeder traffic. Three sections of the system are well under way in construction, other sections are in various stages of design and the remaining portions are scheduled for future design and construction. Several design features of the four-lane dual roadways are as follows: Pavements are constructed on a foundation consisting of 12 ins. of bank-run gravel and 12 ins. of crushed gravel with the paving consisting of 3 ins. of asphaltic concrete base and 2½ ins. of bituminous wearing surface; the medial strip varies from 40 to 90 ft. in width; maximum gradient is 3 percent; maximum curvature 2 degrees; and maximum design speed 70 mph. Full cloverleaf and partial cloverleaf interchanges are being built throughout the network.

"The Granite State Looks to Its Highways." By Bruce D. Zimmerman, Fay, Spofford & Thorndike, Inc., Consulting Engineers, Boston, Mass. PUBLIC WORKS, June, 1959.

New Remote Control Signs

Extreme bad weather that often changed road conditions very rapidly posed a difficult problem in the State of California to keep drivers informed of the conditions of the road ahead. A radio-controlled road sign has been installed to cope with this problem. The sign employs three long three-sided units (triangular in cross section), one above the other, which are rotated by electric motors when the proper circuit is closed. The signal for closing the circuit is provided through a system of relays virtually identical with that used in dialing a telephone. Three-digit signal numbers are used; those in the 500 series are acted upon by one sign, those in the

Why over 700 cities and counties get better signing at lower cost



With a vacuum applicator in your sign shop, you can make all types of professional traffic signs for roads and streets—reflective signs that guide motorists safely and surely day and night.

Fabrication of professional traffic signs with an automatic vacuum applicator is the method now in use by over seven hundred cities and counties to get better signing at lower cost.

The starting point for savings is refurbishing old signs right in your own shop. You can give your old signs new faces in a matter of minutes in an applicator... and actually, you can switch over to red stop signs for as little as $3.60 per sign.

For additional savings, look at those projects you have wanted to start but, perhaps, put off because you thought they might be too costly. Projects like new reflective street name signs, hazard markers—distinctive trailblazers and guide signs that direct motorists day and night for city parkways or county roads. Faces for these signs can be made to order for you at lower cost than you think. All you have to do is apply the face to your sign blank in your applicator. Takes only five minutes.

For instance, you can reflectorize street or road name signs in a 3′ x 4′ applicator that turns out 10 or more of these 6″ x 24″ signs every five minutes.

Or you can make 8″ x 36″ bridge end markers to reduce the danger of darkness with any bridge hazard in your area—for as little as $1.95 per marker face.

Important, too, is the fact that operating an applicator is so simple you don't need specially trained men to make reflective signs. Production is fast—so you won't need extra people in your sign shop even during the busy spring season. When maintenance crews are idled by weather conditions their time can be more fully utilized by sign making jobs in the shop.

Vacuum applicators are available in a variety of sizes—including this new, table top "Economist" model. Designed for small shops, it produces nine 24″ x 24″ reflectorized signs per hour at low cost.

Your 3M Representative can tell you more about how to get the most out of your vacuum applicator—to put more into your signing program. You can get complete information by writing: 3M Company, Dept. RBM-79, St. Paul 6, Minnesota.

Anyone can operate a vacuum applicator—no special training is needed. You can make signs any time you need them—and give your community better safety with better signing at low cost.

MINNESOTA MINING AND MANUFACTURING COMPANY
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SCOTCHLITE
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The term "Scotchlite" is a registered trademark of 3M Co.

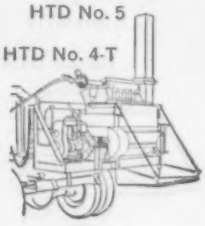
McConnaughay OFFERS
the most complete line of
Asphalt Patching Mixers

3 TO 20 TONS QUALITY HOT MIX PER HOUR

Here are the mixers you need for fast, economical pavement repairs and small surfacing jobs... in any season ...under wet or dry conditions. They are precisely engineered and rigidly constructed to handle on-the-job mixtures of asphaltic concrete, sheet asphalt, sand asphalt or mastic asphalt... hot or cold... at remarkably high rates. They will enable you to meet all conditions with least effort and at lowest possible costs. Write for complete specifications and proportioning tables.

HTD No. 10

HTD No. 5


HTD No. 4-T

McCONNAUGHAY MIXERS, INC.
LAFAYETTE, INDIANA

National distributors: Asphalt Equipment Co.
3314 Cherry Lane, Fort Wayne, Indiana

800 series by the other. When the sign changes and the new message panel drops into place, it closes a pressure switch. This actuates another relay circuit and a transmitter, which sends a signal back to control, turning on a green light at the corresponding position on the control panel. The messages are on glass faces, with lights inside the units, so they can be read at night. The two signs in use were built by Tele-Dynamics, Inc.

"Radio Signs." *California Highways* and *Public Works*, March-April, 1959.

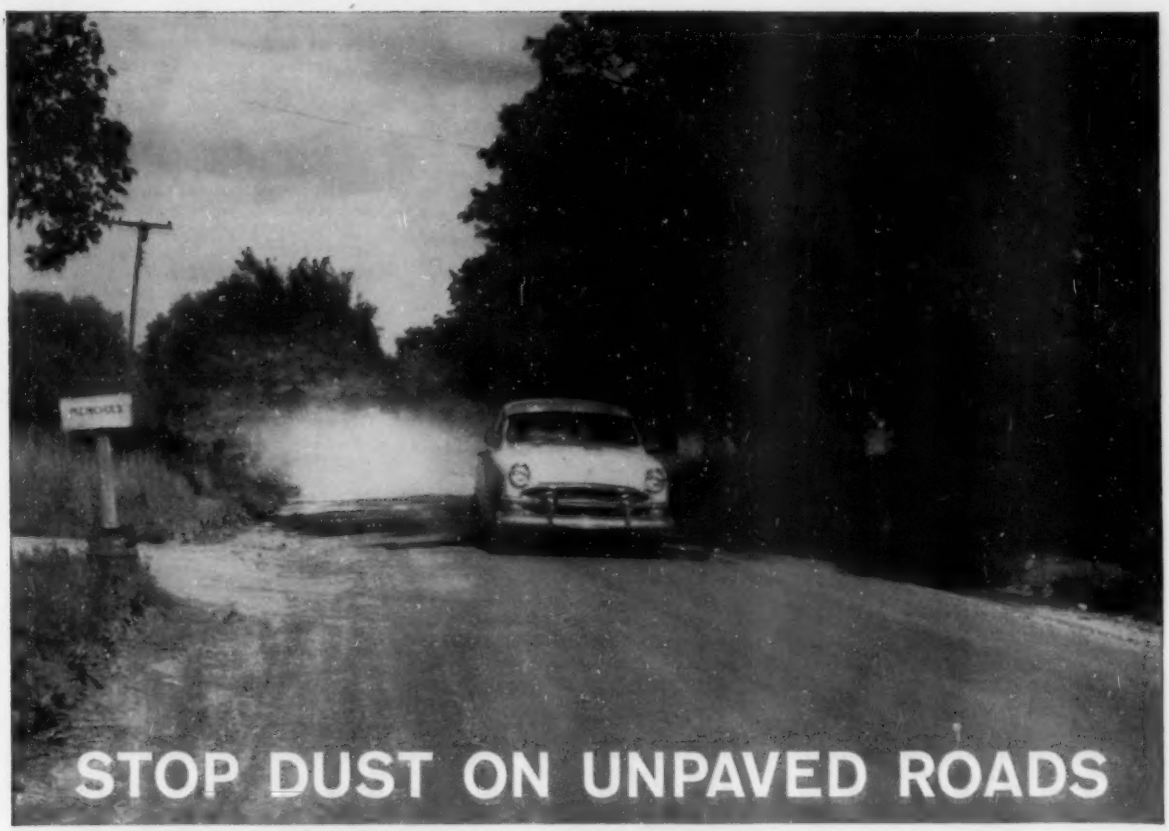
Double Treatment With Slag and Emulsion

Under the low cost paving plan of Birmingham, Ala., residential streets are selected for paving that have light or moderate traffic. There must be no serious drainage problem where pipe must be installed, no grade of more than 10 percent and no curb and gutter required on these streets. The city furnishes the labor and equipment on these jobs and the property owners pay for the materials. Cost of materials is estimated at 25¢ psy. Property owners initiate the work and one citizen is required to handle details of collecting the money and no work is started until all the money is in. The paving consists of a double surface treatment of hot liquid asphalt over a slag base. A well compacted clay surface is desirable, then a 1-in. layer of No. 6 slag is spread, rolled and given an application of 0.6 gal. psy of asphalt emulsion. Another course of finer slag (No. 7 or 8) is then applied as a choke, and shot with 0.4 gal. psy of asphalt emulsion. The surface is then topped with fines (¼-in. down). Two crews are used on this work and the average crew can do a mile in an 8-hour shift.

"Double Treatment with Slag and Emulsion." By J. T. Waggoner, Commissioner of Public Improvements, Birmingham, Ala. *Street Engineering*, May, 1959.

Street Sufficiency Study

The City of Milwaukee recognized the need of analyzing its street system on the basis of functional as well as structural adequacy and after extensive research and many trial studies has developed a sufficiency study. Such a sufficiency study is a means of comparing segments of a street system by reducing their physical characteristics to a numerical value. The system is based on 100 points for a "perfect" street,



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People who live along unpaved roads are quick to complain about dust. Safety officials regard dusty roads as hazards to safe driving. But you can solve these two problems with Columbia Calcium Chloride. This "thirsty" chemical absorbs water from the air *and* helps prevent roadbed moisture from evaporating. Road surfaces stay slightly damp, dust stays settled—even in the hottest weather.

Columbia Calcium Chloride reduces road maintenance costs, too! Its binding properties conserve surface material. New aggregate replacement costs are sharply cut. And only one or two light "sweetening" applications of Columbia Calcium Chloride are needed over the summer to keep roads smooth, dust-free and compact.

If major construction or new road building is scheduled, don't overlook treating dense graded aggregate bases with Columbia Calcium Chloride for effective stabilization. Dusty detours and by-passes a problem? Treat them with calcium chloride to complete your dust control program.

Order ample stocks of Columbia Calcium Chloride for use throughout the summer. Contact your nearest Columbia-Southern District Office or write to our Pittsburgh address.

Columbia Calcium Chloride makes firm, compact, dust-free surfaces like this.

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and is broken down into the two main elements, structural and functional adequacy. These are further broken down into five main factors: Observed condition; life economy; ridability, traffic capacity and safety. The structural adequacy is the condition of the street from a physical standpoint, as determined from a field inspection of actual physical condition; the life economy (expectancy) is determined by field inspections and mortality survivor curves and quality of ride. Functional adequacy is a measure of the street's ability to handle traffic, and a measure of the safety it affords the motorist using the street. The forms used in these studies are explained and illustrated in the article.

"Street Sufficiency Study." By Charles E. Joers, Road Life Study Engineer, Dept. of Public Works, Milwaukee, Wisc. PUBLIC WORKS, June, 1959.

Other Articles

"Heath Insurance Benefits for County Employees." Group Life, Accident and Sickness and Major Medical benefits for all county employees and their dependents with the county paying part of the cost. By Pat Thomson, Douglas County Engineer, Waterville, Wash. Public Works, June, 1959.

"How a **Small City Modernizes Its Street Lighting**." "Do-it-yourself" program plus careful planning produced an effective downtown lighting system at minimum cost. By Richard R. Staley, Administrative Assistant, Corcoran, Calif. Public Works, June, 1959.

"Keep **Urban Highways** in Step with the National Program." By Warren J. Mann, Director of Public Works, Raleigh, N. C. Public Works, June, 1959.

"County Engineers Must Also Be **Public-Relations Experts.**" The men and women who pay the bill have a right to know the whys of public spending. Public relations can make or break any road program attempted. The role of the county engineer in a public-relations program is vital in gaining acceptance and support of the public. By W. H. Metzler, Wayne County Engineer, Wooster, Ohio. Better Roads, April, 1959.

"Trends in **Concrete Paving.**" This is a rundown on the equipment available for concrete pavement construction. By H. A. Radzikowski, Chief, Div. of Development, Bureau of Public Roads. The American City, May, 1959.

"Saint Paul's **Street Cleaning Methods.**" How one major city has gradually expanded and modernized its mechanical fleet for street sweeping, flushing and refuse removal. By J. M. Cotter, Supt. of Sanitation, St. Paul, Minn., Street Engineering, May, 1959.

"Radio Use Doubled By Erie's Street Department." Here are some of the benefits from a current expansion of **two-way radiotelephone facilities.** Street Engineering, May, 1959.

"Parking Garage Design Expands to Urban Development Design." By E. M. Khoury, Consulting Engineer, Canoga Park, Calif. Municipal Construction, April, 1959.

"Tunnelers Dig Past Structures." Job was through ground bad enough to require needle-beam tunneling methods. By T. J. Montgomery, City Engineer, Cincinnati, Ohio. Engineering News-Record, May 21, 1959.

"Europe's Longest **Suspension Bridge.**" By A. W. Coutris, Freyssinet Co., Inc., N. Y. Engineering News-Record, May 14, 1959.

"Timber Posts on Modern Highways." Low-cost, durable wood posts for guardrail, guide markers, fence and sign posts can save money in first cost and maintenance. Wood Preserving News, May, 1959.

• • •

Computer Section of Washington Dept. of Highways

During the month of February, 1959, the productive computer time amounted to 200 hours in the Computer Section of the Washington Dept. of Highways. This is a drop of 20 hours from January, but on the basis of the ratio of working hours in the month, amounts to a 5 percent increase over January.

The earthwork processing jumped

LOWER FIRST COST..... (by ONE-HALF!)

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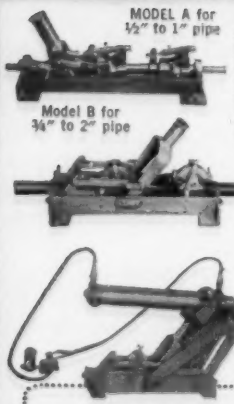

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The Trojan combines pushing and pulling operations in one machine—eliminates all time-killing resetting of grip—keeps pipe continuously moving. Does the job at lower cost—in far less time.

Model A weighs 65 lbs.—requires only 5' trench. One man can easily install the average service. 15 tons of pushing pressure possible.

Model B (either hand or air powered) needs only 5½' trench—has 3 speeds for different soils—is reversible in 30 seconds. Push pipe comes in 30" lengths, assures straight travel.

NEW AIR POWERED Model B
Does all the work for you. Handles ¾" to 2" pipe.

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The LINE RIDER strikes again

(at weeds and brush, that is)

THE LINE RIDER AND HIS GANG of Diamond Chemical killers are deadly for weeds and brush along highways.

You'll want to meet them:

FOR MIXED BRUSH—LINE RIDER LV-3D/3T, a 2-Ethyl Hexyl Ester formulation of 2,4-D and 2,4,5-T containing 3 pounds each of acid equivalent per gallon.

FOR MAPLES AND OAKS—LINE RIDER LV-6T, a 2-Ethyl Hexyl Ester formulation of 2,4,5-T containing 6 pounds of acid equivalent per gallon.

FOR AREAS ADJACENT TO SENSITIVE CROPS—LINE RIDER AMINE 22, alkyl amine salt formulation of 2,4-D and 2,4,5-T containing 2 pounds each acid equivalent per gallon. Applied as a water-borne spray.

FOR SPECIAL CONDITIONS—LINE RIDER formulations, including Butyl and Low Volatile Esters of 2, 4-D and 2, 4, 5-T containing 4 pounds acid equivalent per gallon.

Send for new brochure giving details. Diamond Alkali Company, Union Commerce Bldg., Cleveland 14, Ohio.

Diamond Chemicals

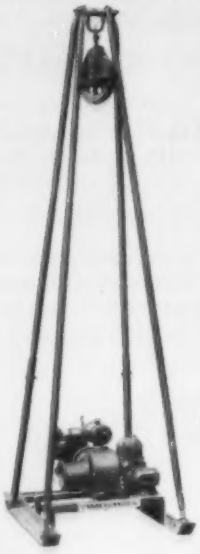
YOUR FIRST NEED IN SOIL SAMPLING

AN

S&H PIPE DRIVING WINCH

INEXPENSIVE • LIGHTWEIGHT • ECONOMICAL

A Sprague & Henwood pipe driving winch is your first requisite for normal soil sampling operations. For shallow holes there is the Model PD, and for the deeper holes, the more rugged Model PDH. Both models are furnished with a tubular steel derrick with telescoping rear legs permitting 10′ pulls. In addition to the skid mounting, there is also available a special trailer mounting that permits operation of the unit as either a skid or trailer-mounted unit. Write today for full particulars. Ask also for Bulletin # 300 which illustrates and describes the complete S & H soil sampling line.



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POW-R-DITCHERS

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to an all-time monthly high with 338 miles of earthwork quantities processed and 24 miles of elevations computed. Parts or all of 30 location and 7 construction projects made up the total processing. The total unit costs, including machines and labor, amounted to $21 per mile.

The number of traverses computed during the month amounted to 1120. Eight traverses were adjusted and 8 spiral problems computed. The traverses were computed for 2 construction and 12 location projects and various bridge layouts for the Bridge Division. The total unit cost, including machines and labor, amounted to 33¢ per traverse.

The Bridge Division had 62 problems computed which included biaxial stress, camber, frame analysis and moment distribution problems. Total machine costs on these problems amounted to $2.18 per problem. Of the traverses mentioned above, 457 were computed for the Bridge Division.

The Toll Bridge Authority had two 20-21 matrix problems and four pontoon stability problems computed. These problems averaged 31 minutes in processing time per problem and unit machine costs amounted to $16 per problem.

The Materials Laboratory had two maximum density problems and six slope stability problems computed as well as equivalent wheel load summary made during the month.

The modification of the Oregon 3-span frame analysis program has been completed and work has begun on the 2-span program. These modifications are being made to handle types of designs used more in Washington than in Oregon. An IBM library program, double precision matrix inversion, tested satisfactorily and will be used by the Toll Bridge Authority.

The overhaul computation program is nearing completion and will soon be ready. All of the data normally found on the mass diagram is computed on the computer. The program is set up to handle both location and construction projects by their individual methods. For location, the engineer will supply shrink and swell factors and the computer will determine balance points. For construction, the engineer will supply the balance points and the computer will determine shrink or swell factors. For both cases, the computer will also determine free haul limits, accumulated overhaul quantities between balance points, and direction of haul.

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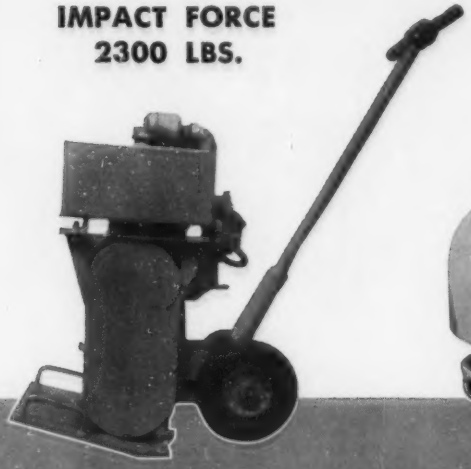
BACKFILL SINKING? *TRENCHES OPEN TOO LONG?*

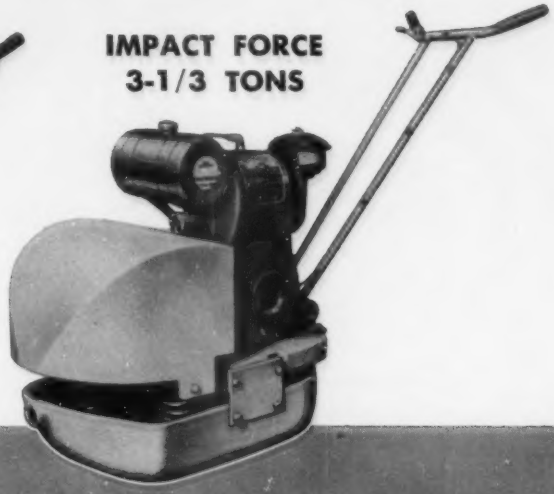
. . . Eliminate with a Terrapac Vibratory Compactor!

IMPACT FORCE 2300 LBS.



TERRAPAC CM-15

IMPACT FORCE 3-1/3 TONS



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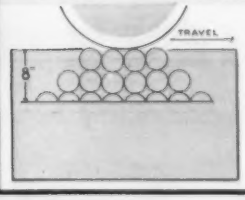
Small, self-propelled, one-man operated, heavy-duty vibratory tampers now enable you to really compact crushed stone, sand, gravel, etc. without bringing in 10-20 ton static rollers. . . . They are also ideal for small asphalt jobs including patch work. . . . The CM-15 will compact lifts up to 12 inches, while the CM-20 penetrates up to 30 inches — in one or two passes. . . . Prove it to yourself — on your own job. . . . To arrange a demonstration, contact your local Vibro-Plus distributor or write to us direct.

Ad 41-80

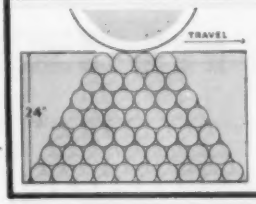
SPECIFICATIONS

	Impact	Frequency VPM	Travel Speed	Weight
CM-15	2300 lbs.	2350	up to 55′ per min.	242 lbs.
CM-20	6600 lbs.	2000	up to 75′ per min.	950 lbs.



CONVENTIONAL STATIC COMPACTION

Static rollers, relying on weight alone, produce friction forces between soil particles causing bridges to form. Terrapacs break bridges for deep compaction.



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Vibratory energy breaks frictional forces binding soil particles together, allows soil to sift down producing uniform densities at greater depths.

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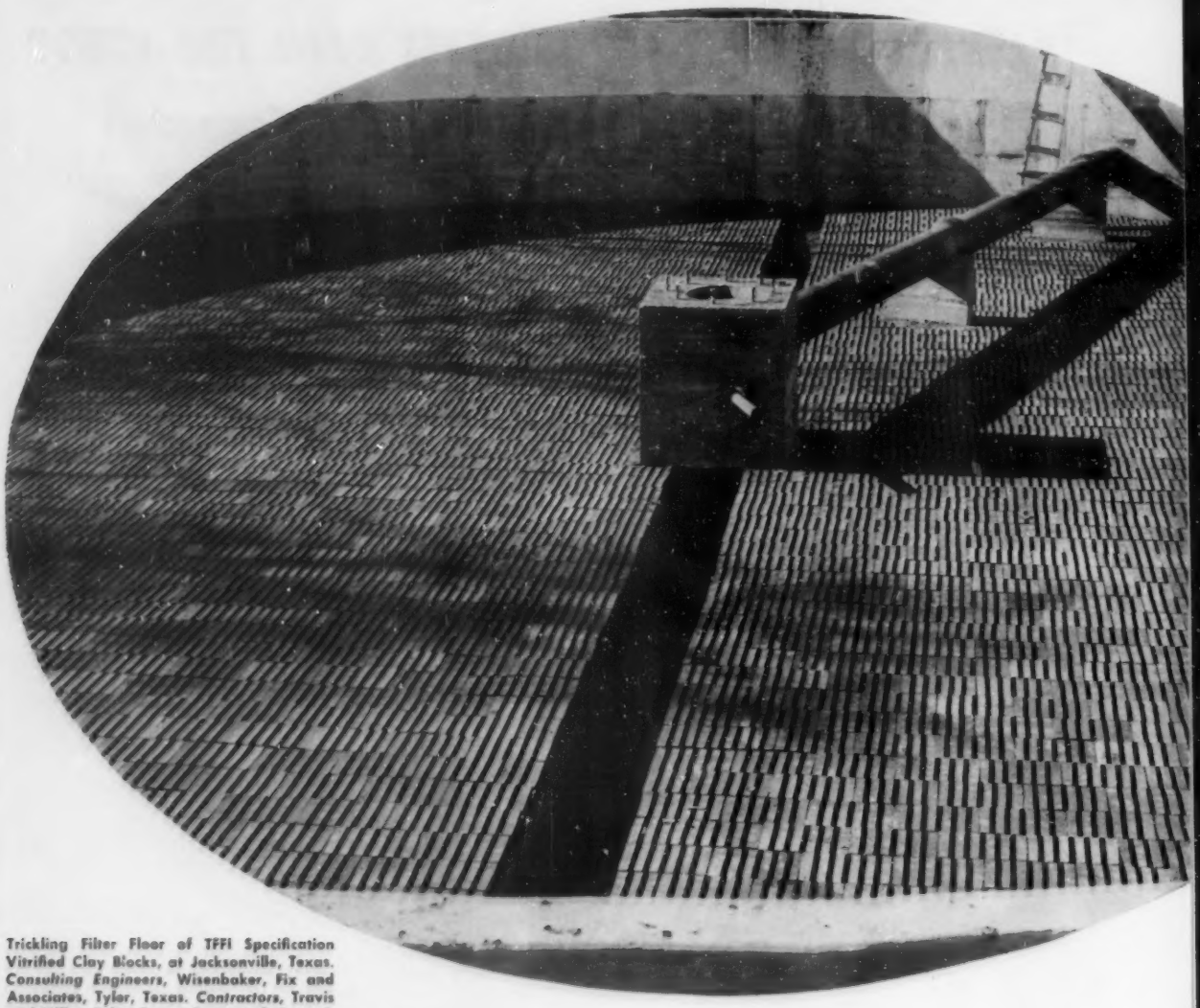
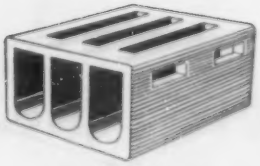
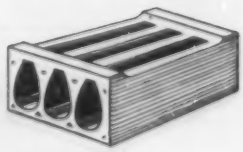


Trickling Filter Floor of TFFI Specification Vitrified Clay Blocks, at Jacksonville, Texas. *Consulting Engineers*, Wisenbaker, Fix and Associates, Tyler, Texas. *Contractors*, Travis and Miller, Tyler, Texas. Screens, sludge collectors by *Link-Belt Co.* Filter distributors and digester equipment by *Ralph B. Carter Co.*

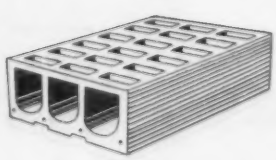
TFFI TRICKLING FILTER



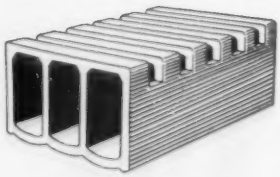
POMONA
Pomona Terra-Cotta Co.
Greensboro, No. Car.



NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.



DICKEY
W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.



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Texas Vitrified Pipe Co.
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by SPECIFYING

the Floor Blocks of TFFI SPECIFICATION VITRIFIED CLAY

Failed underdrains of some substitute material can far more than eat up any "savings" in first cost. The *real* cost of a filter floor is its *final* cost, and that's where TFFI Specification vitrified clay floors lower cost as well as lengthen life. For they alone are made in modern plants under rigid controls of quality that are impossible with any substitute material. Only vitrified clay blocks offer you a 50-Year Guarantee against all ravages of acids, alkalis and bacteria.

Other Advantages

Other advantages of Trickling Filters with vitrified floor blocks are: they safely carry highest hydraulic loadings, afford low initial cost, low operating and maintenance costs. Overloads are no problem and operating personnel is held to an economical minimum.

Helping End Stream Pullution

The TFFI takes pride in its important contribution toward clean waters in America. Over 2,682 sewage works with trickling filters now serve over 35% of our population.

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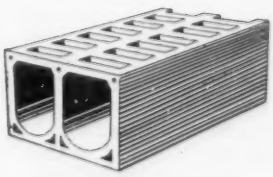
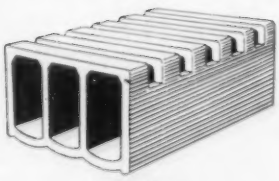
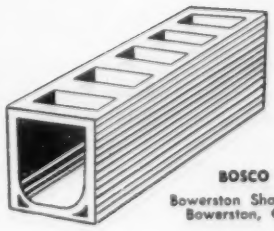


ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

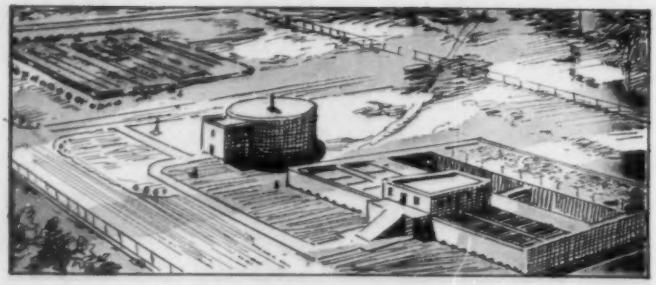


TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

THE SEWERAGE AND REFUSE DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Syndet Research

In order to ascertain the exact effect of commercial alkyl benzene sulfonate (ABS) on sewage the Association of American Soap and Glycerine Producers authorized a series of research projects at various universities. One of these projects was established to investigate the fundamental microbiology of ABS metabolism. The following conclusions were drawn from this study: 1) Common soil and water bacteria which predominate in activated sludge can utilize ABS as their sole source of organic matter. 2) Some bacteria can live in the presence of organic matter and ABS. 3) ABS stimulates the utilization of organic matter in some bacteria. 4) Activated sludge cannot completely degrade ABS. 5) Activated sludge can degrade the basic component parts of the ABS molecule. 6) The failure of activated sludge to degrade ABS completely is caused by a quaternary carbon in the hydrocarbon side chain which blocks metabolism. 7) The quaternary carbon is believed to exist where the hydrocarbon side chain joins the benzene ring.

"Bacterial Degradation of ABS." I. Fundamental Biochemistry. By Ross E. McKinney and James M. Symons. *Sewage and Industrial Wastes*, May, 1959.

Sludge Composting

Although sewage sludge has been used as a fertilizer for vegetable crops, there is a feeling that its use should be restricted to field and grain crops. Reasons for this belief have their origin in a) aesthetic objections, b) objectionable odors, and c) the fear of spreading pathogenic organisms. A limited survey of a sawdust composted sewage sludge was carried out in this study with the focus of attention being directed primarily to the isolation of the pathogenic intestinal bacteria, principally those of the Salmonella and Shigella genera. The composting operation was carried on as follows: Air-dried sludge was placed in windrows approximately 300 ft. in length, 6 ft. wide at the bottom, 4 ft. wide at the top, and 4 ft. high. Windrows of hardwood sawdust were placed alongside. Mixing was accomplished by repeated folding over with a road grader. The combination was wetted with city water at two to three-week intervals and turned with the grader. After two to three months of composting, the material was ground with a Royer shredder, mixed, wetted, and placed in piles approximately 12 ft. wide, 16 ft. long and 6 ft. high. These piles were allowed to remain undisturbed for an additional period of two to three months. Compost samples were taken with a standard soil sampler. The ease with which members of the Salmonella and Shigella genera were isolated is presumptive evidence of the dangers involved in the possible dissemination of disease through the use of composted sewage sludge as a humus. In this study, 61 strains of the genus Salmonella and 12 strains of the genus Shigella were isolated in air dried sludge and hardwood sawdust compost. These preliminary studies have formed the basis for continuing more detailed work to determine if a practical and economical method of control can be obtained.

"Sanitary Aspects of Composted Sewage Sludge and Sawdust." By J. B. Reeves. *Sewage and Industrial Wastes*, May, 1959.

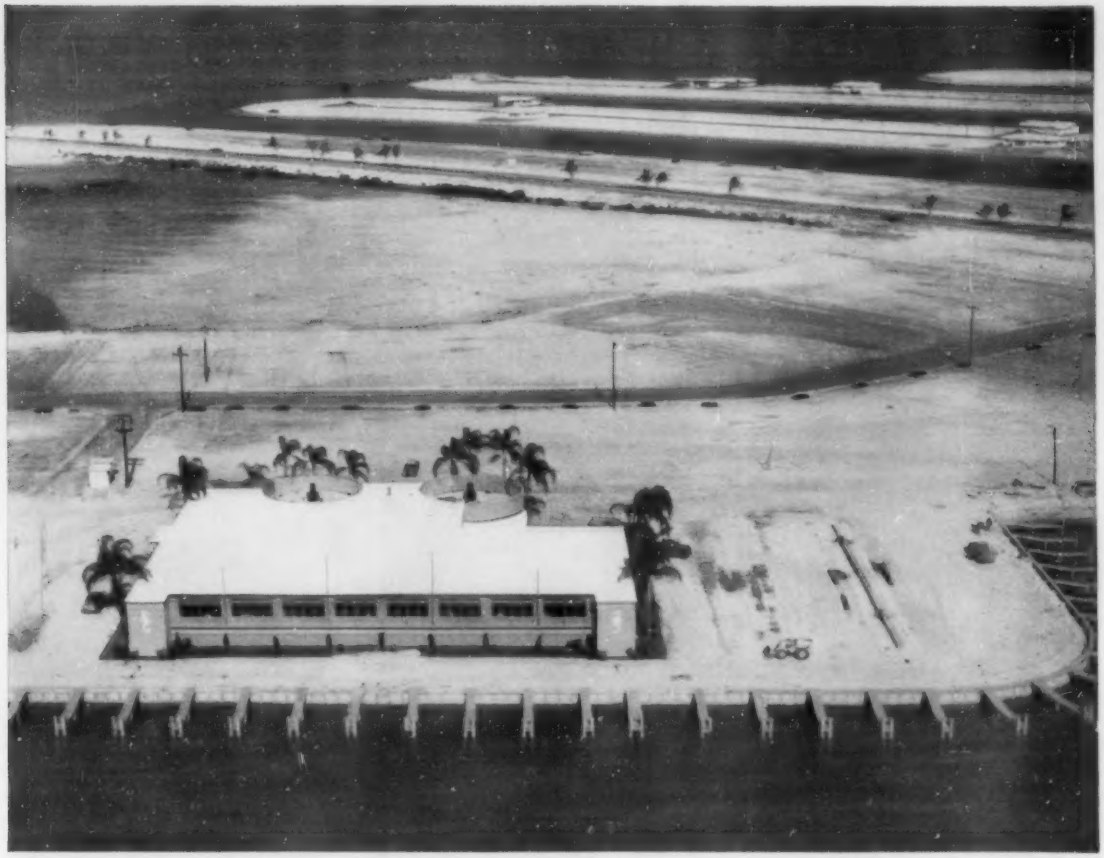
New Plant Old Works

Akron, Ohio, has demonstrated that it is possible to build a 62-mgd activated sludge plant, with all the appurtenant sludge digestion and disposal facilities, around an old Imhoff tank-trickling filter installation with only minor interference with operation. This feat was accomplished over a period of about 6 years while sewage flows mounted and construction costs increased to new highs. The modernization was carried out in stages although a master plan had been provided. The author describes in a step-by-step manner how this conversion was accomplished and his account should be of interest to communities faced with similar modernization and enlargement plans. The new plant consists of roughing grit chambers; three automatic front-cleaned bar screens; four detritors; five comminutors; six primary settling tanks; aeration and final settling tanks; six 95-foot digesters; two sets of elutriation tanks; 2000 sq. ft. of vacuum filters; four multiple-hearth incinerators; a railroad siding; a by-pass conduit; and chlorine equipment.

"New Plant Built Around Old Works With Minor Delays in Operation." By T. C. Schaetzle. *Wastes Engineering*, May, 1959.

Elements of Sludge Digestion

The principal reasons for sludge digestion are: 1) To produce an inoffensive sludge for disposal, 2) to reduce the amount of sludge to be handled for disposal, and 3) to produce a sludge which will dry readily. The sludge in the digester is inhabited by billions of organisms (bacteria and other micro-organisms) of many types. Products produced by one group are consumed as food by other groups. New organisms are continuously being produced, and others are being consumed as food by still other organisms. These activities are all going on in the digester at the same time and continue until most of the bacterially edible elements have been consumed and the digester contents



Clearwater, Florida's new Marina Station Sewage Treatment Plant serves the Clearwater Beach area and Marina facilities for this growing resort area. P.F.T. equipment plays an important part in this attractive, modern plant. *Briley, Wild & Associates, Daytona Beach, were the Consulting Engineers.*

Clearwater's new treatment plant enhances boating facilities for resort area

In the midst of the much sought after marina mooring facilities this architecturally attractive, completely enclosed treatment plant blends into the recreational features of the area. Even the air in the ventilation system is treated with ozone to assure the elimination of all odor.

The digested sewage sludge will be hauled in an especially designed tank truck to the main city treatment plant site for disposal.

Clearwater's Marina Station is a progressive solution to a modern sewage treatment problem. It is a fine combination of modern planning and modern equipment.

The P.F.T. equipment at Marina Station includes: two 40' Floating Covers, one P.F.T. Pearth Gas Recirculation Unit, two Liquidometer Position indicators with High and Low Level Alarms, two Supernatant Selectors and Gauges, one lot of Gas Safety Equipment, one #170 Heater and Heat Exchanger Unit.

Waste Treatment Equipment
Exclusively since 1893

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have become stable. When sewage solids undergo decomposition, they pass through three stages: 1) Acidification—a period of intense acid production, 2) Liquefaction—a period of acid digestion, and 3) Gasification—a period of intensive digestion and stabilization. The author discusses the factors affecting sludge digestion that can be controlled, namely: a) Seeding, b) temperature and c) reaction. The problems of starting a digester, excessive scum and foaming are also covered in this article. There is no attempt to present any new or original ideas in this article, but rather to set down in as clear and understandable a form as possible, material that may be of help to the new or less experienced treatment works operator.

"Elements of Sludge Digestion." By A. Paul Troemper. *Water & Sewage Works*, May, 1959.

Direct Charge Incinerators

Recent experience at Durham, N. C., indicates that the bee-hive type incinerator furnace is low in initial cost, operating cost and reconstruction and modernization cost as well. Last year the city undertook to remodel the four existing 150-ton furnaces and add two new 170-ton units to increase overall capacity. The rebuilding of the existing furnaces included construction of new domes on all the units, new walls in two furnaces and relining of the four combustion chambers, flue walls and arches. In addition, six hydraulically operated dumping grates were installed near the center of each furnace to increase operating efficiency. The two new 170-ton furnaces, also of the bee-hive type, incorporate improvements such as greater furnace height and volume, larger charging openings, over-fire air doors, deeper ash hoppers, hydraulically operated dumping grates and ash discharge grates and greater combustion chamber volume. A hopper, located in the combustion chamber, is used to remove fly ash deposited by precipitation.

"Direct Charge Incinerators Can Do a Good Job." By C. F. Wheeler. *The American City*, May, 1959.

Safety in Plant Operation

Sewage treatment plants have many areas where physical injuries may occur. Open settling tanks, open pits and manhole shafts, moving machinery, ladders, electrical equipment, laboratories and the danger of fire are a few examples of potential hazards. Protective railings, adequate precautions against electrical shocks, falls and fires must be stressed in safety programs. Identification of hazards, use of safety belts and other protective apparel must also be encouraged. Good housekeeping prevents physical injuries. Hazardous jobs call for adequate personnel, using the proper tools, and working under the supervision of a trained foreman. In addition to the usual body infections in any occupation, sewage plant employees are subjected to additional potential hazards. These include typhoid fever, paratyphoid fever, amoebic dysentery, infectious jaundice and the danger from tetanus. The wearing of rubber gloves should be mandatory when workers have to place their hands in sewage, clean sludge pumps or handle screenings and other contaminated materials at sewage treatment plants. Avoiding dangers from gases or vapors that are directly or indirectly injurious or destructive to health or life must always be stressed. Safety equipment for these hazards are respiratory-protective apparatus, nonsparking tools, artificial respiration and inhalators. In addition, the initial action for accident prevention and an adequate safety program

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COMMISSIONER SUPERINTENDENT

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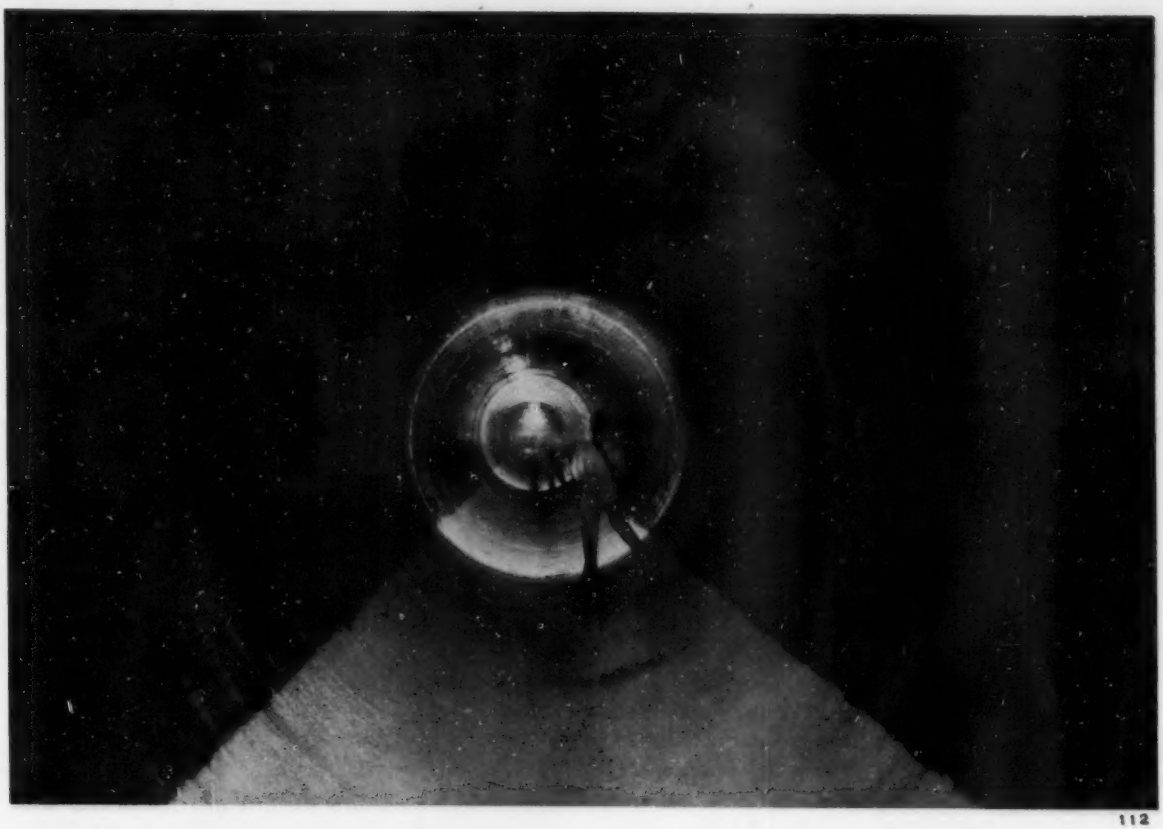


112

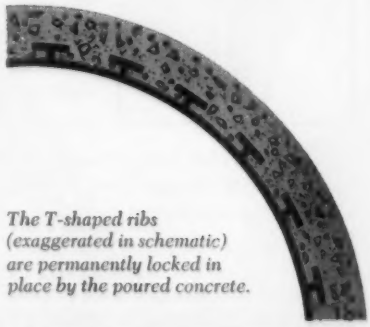
This Sewer will go a Long Way

Not only will this 9½-foot outfall sewer extend eight miles, but it will go a long way in years of trouble-free service. The engineers who designed it say that it will still be functioning perfectly in the year 2000.

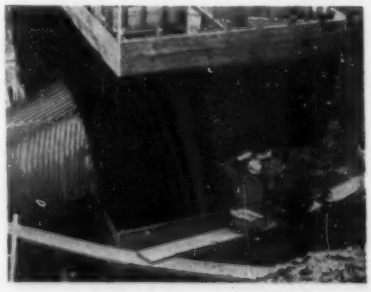
Their confidence is based on wise choice of construction materials. Every joint of pipe, every foot of monolithic tunnel, every structure is built of reinforced concrete to obtain structural strength at low cost. Every surface above the low flow line is completely covered by a continuous membrane of T-Lock Amer-Plate®, the vinyl lining that is impervious to the corrosive action of oxidized hydrogen sulfide *at any level of concentration.*

The engineers know that no one can accurately predict future rates of H_2S gas generation, so they have insured the ultimate life of the concrete by investing an extra 8 to 10% for T-Lock protection. They predict that this "extra" will spare their city the cost of a replacement sewer in about 20 years, and *save the taxpayers millions of dollars!*

Because of obvious and substantial savings such as this, millions of square feet of T-Lock are now in use in progressive municipalities from coast to coast. These include Los Angeles; Topeka; Wichita; Sioux **Falls; Shreveport;** Washington, D.C.; San Diego; Mansfield, Ohio; Huntington, W.Va.; Hutchinson, Kan.; and Orange County, Calif. T-Lock Amer-Plate is also on current specifications for many other municipalities. For complete list of users and specifiers, plus technical data and a typical specification, write:



The T-shaped ribs (exaggerated in schematic) are permanently locked in place by the poured concrete.



There is no limitation on size or shape of structures which may be protected with T-Lock Amer-Plate.

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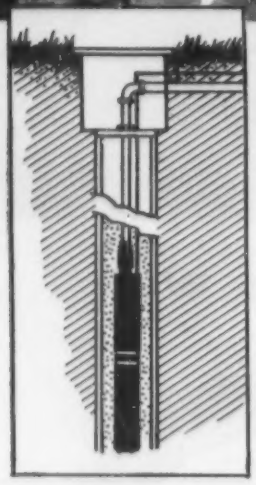
Picture of a 2000 gpm SUMO Submersible water pump installation!



Yes! That's the beauty of a Sumo Submersible. No pump house or other protection is needed to safeguard the motor against freezing, dampness or tampering. The Sumo Submersible operates completely inside the well — pump and motor both — under water.

The idea is not new. It's not radical. It's just plain commonsense engineering as Sumo has proved after almost 50 years of specializing in the submersible pump field. The motor is coupled directly to the pump and forms a complete, compact unit that makes more efficient use of power . . . provides a neater, simpler installation . . . and assures long, troublefree operation.

Sumo Submersible Pumps come in a full range of sizes up to 120 hp with capacities to 2000 gpm. Consider their use for any deep well requirement whether it be commercial, industrial or municipal. They'll quickly pay for themselves.

Write for information. Ask for literature on Sumo high-capacity pumps. For specific recommendations, state your water requirements and the depth of the well. Engineering assistance is always available without obligation.

SUMO SUBMERSIBLE DRAINER PUMPS

For pumping water containing up to 20% solids. Ideal for dewatering or flooding or use in areas where internal combustion engine driven pumps present a hazard. Capacities up to 400 gpm. *Write for literature.*

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The Complete Line from 1/3 hp to 120 hp

must start from management if it is to be effective.

"Safety in Sewage Treatment Plant Operation." By Leroy W. VanKleeck, PUBLIC WORKS, *June*, 1959.

Other Articles

"1958 Literature Review. A review of the literature of 1958 on sewage, waste treatment and water pollution." Analytical methods; sewage, physical and chemical methods of treatment; sludge treatment, disposal and utilization; detergents; lagooning. By Research Committee, Federation of Sewage and Industrial Wastes Associations. H. Heukelekian, Chairman. Sewage and Industrial Wastes, May, 1959.

"Camouflaged Sewage Treatment." Clearwater, Fla., combines a marina with a sewage treatment plant by using attractive architectural and resourceful engineering design. The American City, May, 1959.

"Sewage Treatment **Plant will Grow With Population.**" Master Plan for sewage collection and treatment results in a plant designed for flexibility and future expansion. By J. L. Robinson. Public Works, June, 1959.

• • •

Water Plant Instrumentation

(*Continued from page* 97)

installed to dilute the sample with zero turbidity water at any predetermined ratio. The sample line and the dilution water line both have rotameters upstream from the analyzer to set the dilution ratio desired. For example, let us say that 5 gpm of the river water and 5 gpm of dilution water are simultaneously fed to the analyzer; the range of the turbidity analyzer is now 0 to 4,000 ppm. By varying this ratio, almost any desired range can be achieved while keeping the concentrations in the analyzer less than 2,000 ppm. All that is necessary at the recorder, is to mark the time limits where a multiplier is required and note the multiplier. The amplifier furnished for the raw water turbidity analyzer at this plant has a scale expansion switch included which can electrically change the instrument scale from 0 to 2,000 ppm to 0 to 1,000 ppm if so desired. This can be used during winter low river flows with the resultant lower turbidities, giving the operator greater readibility of the recorder.

For sampling raw water from surface supplies, such as the Missouri River in this case, it is necessary to remove large solids such as weeds, straw, fish, and sand grains larger than ⅛-inch which will introduce errors in the flow colorimeter.

Flow through a turbidity analyzer

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"K&M" Asbestos-Cement Pressure Pipe is as modern as the Jet Age in which we live.

The bore remains smooth and clean always. Pumping costs remain low. Made of tough, high-tensile-strength asbestos fibers and portland cement, it's practically indestructible. Won't corrode or tuberculate. And, it's completely immune to electrolysis. Joints are permanently, automatically root-tight and water-tight.

The finest coupling in the industry! Exclusive patented "K&M" FLUID-TITE Coupling connects in two easy steps. Seals tight and stays tight . . . no matter how high the pressure climbs. Self-energizing sealing rings.

"K&M" Asbestos-Cement Pressure Pipe is a thrifty pipe. Its lightweight reduces shipping and handling costs. You can install it in practically all kinds of weather and soil conditions . . . with unskilled labor . . . and without heavy machinery. And, lay more pipe per hour than ever before.

What makes "K&M" Asbestos-Cement Pressure Pipe so special? Eighty-five years of asbestos engineering by one of America's pioneers in asbestos products. For more information, write to us today.

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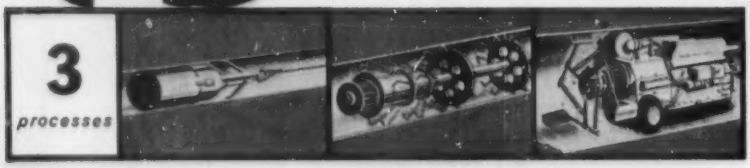
WHETHER BIG,

OR VERY SMALL...

PIPE LININGS MEN CAN FIX THEM ALL

Yes, Sir! Rehabilitation of old, corroded and leaky pipe lines has been our business for many years. We repair pipe interiors with cement mortar lining... all the way up from four inches to as big as 144 inches. And mostly, this rehabilitation is done "in place," underground.



THE TATE PROCESS is for pipe diameters from 4" to 16" and is done, "in place," after by-pass lines are set up to carry on with water service.

First, the pipe is scraped and cleaned. Then, cement mortar is fed in and applied under pressure to a compact thickness of 3/16" to 1/4" giving the final effect of one continuous, cement mortar lined tube.

THE SPUNLINE PROCESS is partly TATE and partly centrifugal, developed to provide a thin lining for preventing corrosion and to restore hydraulic flow, particularly in cast iron pipe. The cement mortar lining can go past fittings and openings. It can be applied "in place." Uninterrupted continuity is obtained.

CENTRILINE Centrifugal Process. Cement mortar lining ingredients are mixed to rigid requirements and applied under a high velocity spray with uniform speed. Rotating steel trowels spread the mortar to a smooth, hard finish. Pipe sizes vary from 16" on up to 144". Clay, cement, brick, steel, cast iron and wrought iron pipes may be CENTRILINED.

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outside pipe coating which may be applied either at the central Wilmington, California, plant, or at railhead plants elsewhere.

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must be high enough, approximately four feet per second, to carry the heavy solids in suspension. The maximum flow through a turbidity analyzer is limited by 1) pressure drop available, and 2) maximum pressure drop permissible without introducing bubbles caused by gases.

If it is desired to have the sample flow by gravity through an analyzer, the hydraulic head available requires careful study. The pressure drop across valves, piping, rotameters and the analyzer requires determining. Additional head, sufficient to obtain the required 4 fps line velocity, is also required. The pressure drop across the raw and settled water and filter influent analyzers, respectively, for this installation is:

$$\Delta P = \left(\frac{Q}{1.64}\right)^{1.48} \text{ and } \Delta P = \left(\frac{Q}{6.1}\right)^{1.6}.$$

Q is in gallons per minute and ΔP is in inches of water. The flow rate used in this installation is ten gallons per minute.

Upon placing a unit in service, the input signal from the sensing element to the amplifier must be adjusted to a required level so that the electrical controls in the amplifier will be able to compensate for minor changes due to deposits on the windows of the sample cell, aging of the lamp, etc.

The windows require cleaning periodically, the frequency depending upon location or use. Cleanout plugs are provided on all units for access to the windows. A small semi-hard brush, or any other object which will not scratch the windows, is the only tool required for this operation.

Because of progressive thinking on the part of the Water Department administrative personnel and their recognition of the fact that the use of instrumentation and centralized control would permit optimum economy and efficiency for plant operation, this plant, though originally constructed in 1927, is now one of the most modern plants in the world. From experience gained at this plant, the use of process analysis and control instrumentation has proven its value enabling the operating personnel to produce a better quality product more efficiently. It has also been determined that, with the use of the central control stations, a substantial saving of labor has been realized. With the addition of equipment of this nature, the department has organized and trained instrument technicians for maintenance.

Books and Reprints For Your Engineering Library

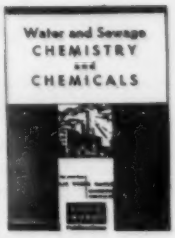
Water Supply and Purification

By W. A. Hardenbergh

Among the major changes introduced in this latest edition are the following: The chapters on ground water, on filtration, and on laying pipe and maintaining lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up-to-date; and a new chapter has been added on fluoridation. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-1 on the coupon.

$7.25 **A-1**

Water and Sewage Chemistry and Chemicals



If you are not an expert chemist but want a dependable text on chemistry as applied to sewerage and water works—send for thi valuable reprint today. Written in plain language so anyone can understand it. Four color illustrations are used to show the exact nature of colorimetric reaction in some specific laboratory tests — something that is possible only with this type of work. Of special interest to water or sewage plant operators. To order your copy circle number A-2 on the coupon.

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What You Should Know About Soil Engineering

Soil Engineering is the practical application of engineering principles to problems involving the use of soil, either in its natural condition or as a construction material. In this authoritative booklet all phases of soil engineering are treated in simple, easily understandable language. Full information is provided on basic soil properties, classification systems, field and laboratory tests, frost action and compaction. Liberally illustrated and containing many special charts and graphs. To order your copy circle A-3 on the coupon.

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Patching Pavements Properly

Designed as a general review for the top men and a practical guide for the men in actual charge of the work. Written in down-to-earth language for easy understanding and application. Fills a long felt need for a complete and precise patching article. All types of pavements and all kinds of patching material and equipment are described and illustrated in considerable detail. Among the many subjects discussed are the general causes for failure; the various materials and equipment used in patching; and the process of making the patch. To order your copy circle number A-4.

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ALGAE of Importance in Water Supply

This major article was prepared in close collaboration with U.S. Public Health service authorities. It includes, for the first time in magazine history, full and accurate color plates for the identification of types of algae most important in water supplies—those which cause taste and odors, clog filters or are likely to be found in clean or polluted waters. Color plates of this quality have never before been available to simplify the job of algae identification. To order your copy circle A-5 on the coupon.

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Sewerage and Sewage Treatment

By W. A. Hardenbergh

An authoritative yet simple treatment of the subject by one of the nation's foremost authorities. Mr. Hardenbergh's editorial and field work has brought him in close contact with the problems that trouble the average engineer and in this book he explains those methods most suitable for general use. Special attention is paid to sewerage systems, both storm and sanitary. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle A-6 on the coupon.

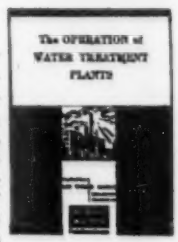
$7.25 **A-6**

The Operation of Sewage Treatment Plants

This valuable text has been completely revised, expanded and brought up to date. In it all phases of Sewage Treatment Plant operation are treated in simple, easily understandable language. Among the many subjects covered are: measurement flow; concentration and temperature; sampling sewage for analysis; laboratory determinations; purposes of treatment; operation of grit chambers; operation of screens; trickling filter operation; filter fly control; disposal of sludge; etc. To order your copy circle A-7 on the coupon.

$1.00 **A-7**

The Operation of Water Treatment Plants



Here in one place you have the basic information concerning all phases of plant operation. Even those without previous technical school education will find it easy to learn from this valuable text. Completely revised, expanded and brought up to date by Clayton H. Billings, Associate Editor of Public Works. This reprint is of special interest to Water Works Superintendents, Water Treatment Plant Operators and everyone connected with the Water Works field. To order your copy circle A-8 on the coupon.

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STEEL WATER LINE SURVIVES ADVERSE CONDITIONS

A 10-MILE water supply line of coal-tar-enameled welded steel pipe, laid down in 1932, is still giving unimpaired service after 27 years of exposure to the ravage of floods and the corroding effects of aggressive soil, coal banks, mine cave-ins, and immersion in mine runoff water.

The 30-inch line runs through rugged Schuylkill County, Pa., terrain from Still Creek reservoir to communities in the Panther Valley, in the anthracite coal mining region. For five miles it follows the Little Schuylkill River valley and for the remainder of the way traverses the Panther Creek valley. During floods in 1955 it was laid bare of cover for upwards of 1,000 feet and in many places lengths of 50 to 60 feet were left unsupported, with no apparent damage.

The need for many special fittings attests to the difficult nature of the terrain. Throughout the line there are a total of 85 special bends with a maximum curvature of 70° 40′ and a minimum of 4° 4′, plus 80 vertical bends with a maximum of 40° 36′. These bends were fabricated of ⅜-in. plate, welded in four or five sections with a center radius of 6 to 10 feet.

The line, fabricated by Bethlehem Steel Company, was installed by the Panther Valley Water Company, of Lansford. It enjoys the distinction of being the first large steel water pipe to which the coal tar enamel coating was centrifugally applied.

In the field, three and sometimes four 30-foot sections were welded together. These were lowered into the trench and joined to previously laid sections by means of flexible couplings fitted with rubber gaskets. Along the line there are seven 30-inch gate valves and 48 manholes; also approximately 100 additional connections for air valves, drains and other piping systems. Since installation in 1932, the line has been carrying 15,000,000 gallons of water daily.

Engineers for the line were Gannett, Seelye & Fleming, now Gannett, Fleming, Corddry & Carpenter, Inc., Harrisburg, Pa.

● PICTURE taken 27 years ago when this 30-inch line was laid shows difficult soil condition and one of 85 horizontal bends; there were also 80 vertical bends.

● LINE WAS laid in valley of Little Schuylkill River, under heavy fill at the left of picture. Flood four years ago exposed 1,000 ft. line but caused no damage.

● ACID water draining from culm banks, the result of coal mining in the area, washes constantly over portions of the pipe, but has caused no apparent corrosion.

Municipalities and Counties Authorized to Create Port Authorities

A recent Indiana law authorizes any municipal corporation, county or combination thereof to create a Port Authority (except counties having three or more second-class cities). The area of jurisdiction of a Port Authority includes all the territory of the political subdivisions creating it, provided the same area not be included in more than one. A Port Authority shall be governed by a Board of Directors which shall be divided among political subdivisions by agreement. A Port Authority shall have authority to purchase, sell, lease and operate docks, warehouses and terminal or transportation facilities and charge for the use thereof; straighten, deepen, and improve canals, channels, rivers or any watercourse as may be necessary.

Airport Facilities in Wayne County, Mich.

The terminal building construction of the Detroit Metropolitan Wayne County airport was financed by the issuance of $6,585,000 of Airport Revenue Bonds and a supplemental issue of similar bonds in the amount of $500,000 which was offered for sale at the close of the operating year of 1958.

All revenues from the Airport operations are, by convenants contained in the bonds, required to be paid into a receiving fund from which operation and maintenance costs are paid with a balance of the fund dedicated to payment of principal and interest on the bonds, creation of a reserve account and construction of additional improvements.

Illinois Water Works Management Course

The 18th Annual Water Works Management Short Course, sponsored by the Illinois and Indiana Sections, AWWA, will be held at Allerton Park, near Monticello, Ill., Oct. 26-30. T. E. Larson of the State Water Survey, Urbana, Ill., can provide more information.

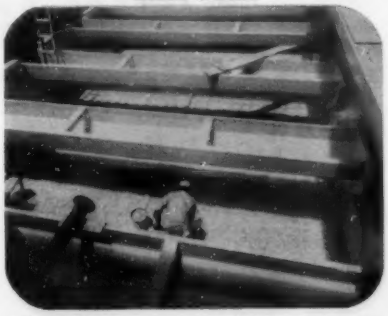
Cost of Treating New York City Sewage

The average cost of treating New York City's 290 billion gallons of sewage was $26.03 per million gallons; removal of 600 million pounds of pollutants, both solids and BOD, was effected at a cost of $0.0126 per pound.

How to keep water in!

All Concrete Masonry NEEDS CONCRETE PROTECTION —THOROSEAL PROTECTION!

Before THOROSEAL was applied, note porous concrete structure.



THOROSEAL has now completely filled and sealed the concrete against all weathering and loss of water.

Contractor—PITT CONSTRUCTION COMPANY.
Subcontractor—
FRED HOWLAND CONSTRUCTION COMPANY.

Just like concrete, THOROSEAL is cement-based, and therefore perfectly compatible with the concrete masonry to which it is applied; actually becomes part of the structure!

Here, the City of Miami's Department of Water and Sewers Maintenance Crew is applying THOROSEAL to all the masonry of their new 2,500,000 gallon Alexander Orr Filtration Plant. Although the poured concrete structures of these tanks are excellent examples of engineering, it was imperative that they would not deteriorate from constant water pressure.

The interior and exterior surfaces of the elaborate structure were given one brush coat of STANDARD GRAY THOROSEAL and one trowel coat of PEARL GRAY THOROSEAL. THOROSHEEN RW 7, acrylic masonry paint, was applied over the THOROSEAL, for extra beauty, in several areas.

The City of Miami's foresightedness in taking these precautionary steps will save them thousands of dollars in maintenance costs and water loss due to leakage.

THOROSEAL also protects the outside masonry of filtration plant against the elements and deterioration.

Write for our new 20 page Specification, Guide No. PW-17 just off the press.

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NEW!
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. . . For all piping — metal, concrete, tile
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Among the toughest, most durable resins known to modern chemistry, Shell Epon 1001 is an ideal interior pipeline coating for potable water lines. It has an outstanding record of performance as a chemical-resisting coating for oil pipelines, tank interiors, and as a finish coating for appliances, trucks, and plant equipment exposed to corrosive fumes.

Conventionally cured coatings of Epon 1001 have truly remarkable adhesion, especially to metals, excellent resistance to impact, cavitation, and abrasion. Outstandingly resistant to water erosion, Epon 1001 interior pipe coatings have given years of service, even in difficult water areas, with no perceptible deterioration or contamination of supply.

Epon 1001 may be applied by brush, spray or pig. Setting takes place at room temperature within an hour or so. Curing time may be considerably shortened by the application of heat.

The best news of all is that Epon 1001 pipeline coating can reduce your maintenance costs, no matter what your potable water condition . . . and often enables you to supply higher purity water.

* * *

Contact your nearest Shell Chemical district office for complete information on this important new development. Your Shell Chemical district representative has all the facts you need to help you get started right away.

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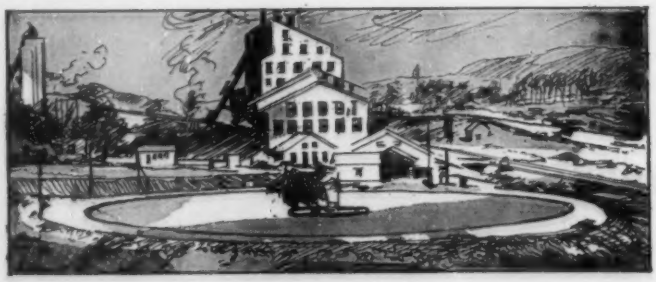


Prepared by **CLAYTON H. BILLINGS,** *Associate Editor*

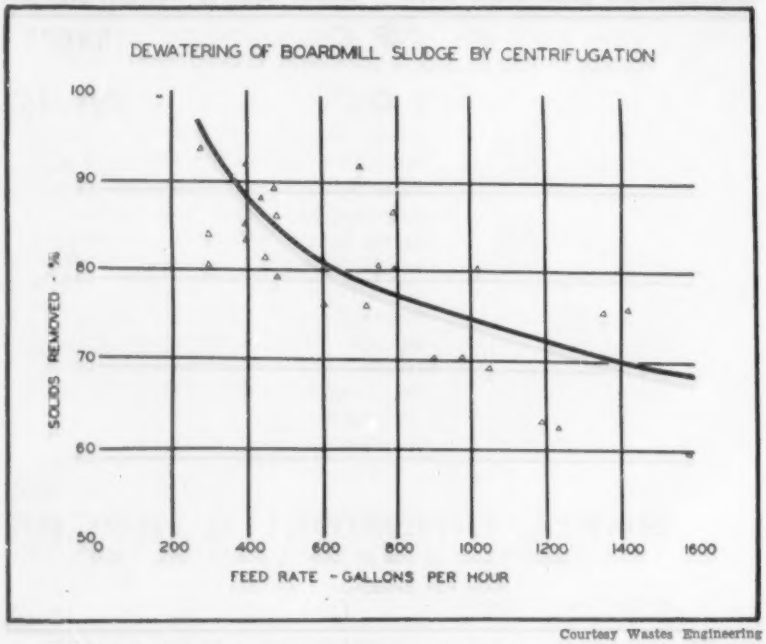
Cellulose Waste Lagoons

The method of producing chemical cellulose at the Jesup, Georgia, Division of Rayonier, Inc., consists of cooking barked and chipped wood in an alkaline atmosphere under pressure. The resulting cellulose fiber is separated from black liquor, bleached and dried. The black liquor is reclaimed for heat value; wastes occur from the bleach plant, screen room, causticizing room, digester and recovery areas. The receiving wasteway, the Altamaha River, is used for sport and commercial fishing, making imperative the maintenance of an adequate dissolved oxygen level. The waste from the first mill was found to cause depletions of only 0.6 to 0.8 mg/L. With two mills in use, the management decided that facilities should be installed to reduce the load on the stream to 175 percent of that from one mill. A survey showed that the waste splits in two definite segments; the high volume low BOD wash water from bleaching, screening and causticizing operations; and the high BOD, low volume component from the digester and recovery areas. Two collection systems were constructed, each discharging to a separate lagoon. The lagoon containing the digester wastes had a retention period of 60 days. That for the low BOD wastes is used primarily for settling and compositing the waste. It receives the effluent from the digester lagoon before discharge to the river. Instrumentation is provided to permit switching contaminated condensates to the larger lagoon should operating difficulties occur in the black liquor evaporators or in the barometric condenser. The controls are based on conductivity designed to sound an alarm when concentrations exceed normal levels. Arrangements have been made to switch the black liquor evaporator condensate automatically; the other operation is manual. Continuous records are provided of volume, pH, conductivity and color at appropriate points. After a year of operation, the dissolved oxygen concentration in the river has remained satisfactory, and substantial reductions have been accomplished in BOD, resin acids, mercaptans and sulfides in the mill waste.

"Lagoon System for Chemical Cellulose Waste." By W. A. Cawley and C. C. Wells, Jr. *Industrial Wastes*, May, 1959.

Centrifuging Paper Mill Sludge

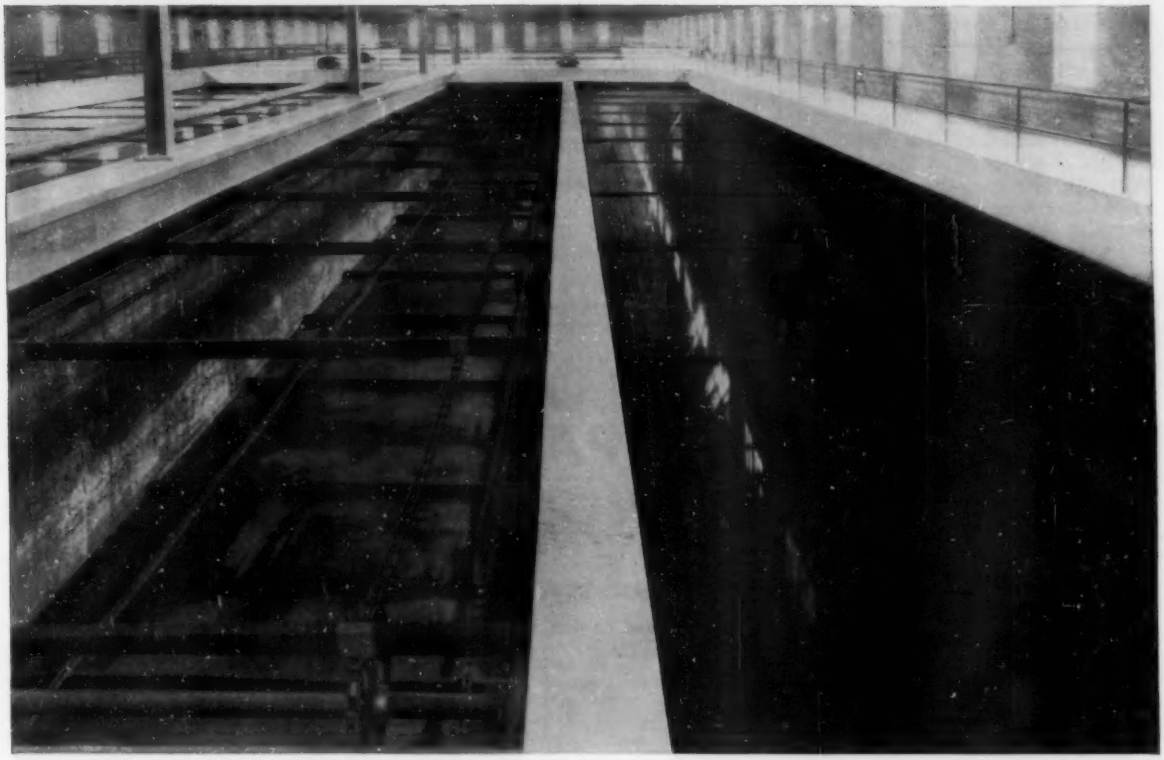
The sludge disposal problem in the treatment of pulp and paper mill waste remains unsolved despite extensive research. A major reason is the complex nature of the slurries produced by sedimentation of the wastes. The interstitial water is difficult to remove, and the water of imbibition, which is bound in the colloidal sols, cannot be removed by mechanical means. The result is a slurry too dilute for ready handling by ordinary dewatering means. Bench scale models of two new types of centrifuges, still under development, were tried in the Syracuse University project of the National Council for Stream Improvement. One of these is a vertical disc centrifuge, with a top feed arrangement for the slurry and in which the slurry is forced down through a rotating bowl and then upward through perforated discs. The separation starts at the aligned holes in the discs, with the more concentrated liquid being extracted first.



Courtesy Wastes Engineering

● **TESTS with dewatering papermill waste sludge with the new type vertical disc centrifuge show promise of solving a difficult industrial waste treatment problem.**

The Rex Record at Racine, Wisconsin



Rex Primary Sludge Collectors at the Racine, Wis., sewage disposal plant. Rex Equipment at this plant includes longitudinal and cross collectors... grit collectors and washers... bar screens and triturators.

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The other is a horizontal conveyor type machine which includes a horizontally suspended rotating bowl, containing a helical screw conveyor which rotates at a slightly lower speed than the bowl. The slurry is fed through a hollow shaft and the liquid-solid separation occurs in concentric rings adjacent to the bowl wall. After promising bench scale results the centrifuges were installed for mill-scale tests. Using sludge from the sedimentation of white water from a news and chip board mill, the solids recovery varied from 97 percent at a feed rate of 280 gallons per hour to 69 percent at 800 gph. The sludge cake consistency was 11 to 12 percent.

The tests with the horizontal conveyor type machine were made with sludges from sedimentation of fine paper, box board, rag paper and roofing felt machine waters. Cakes of over 30 percent solids content at a solids recovery greater than 85 percent were obtained with fine paper sludges. The boxboard sludges yielded a cake of 10 percent solids content with a solids recovery of 91.9 percent. With rag papermill sludge, a cake of 28 percent solids was obtained. Poorest results were realized with roofing felt sludge because of its high content of fine colloids. In general it appears that centrifuges have been developed to the point where they will find successful application to papermill sludge thickening problems.

"New 'Wrinkles' for Dewatering Difficult Paper Mill Sludges." By H. W. Gehm. *Wastes Engineering*, May, 1959.

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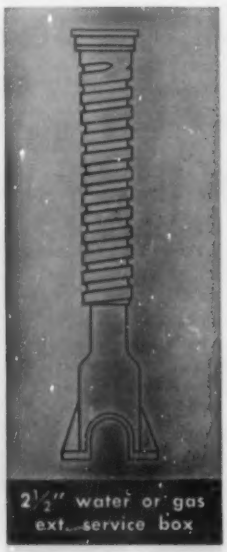

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Zirconium Wastes Attaining Importance

Wide use is being made of zirconium in building nuclear reactors because of heat, corrosion, and radiation resistant properties. Zirconium production was 160,000 lbs. in 1953. which was doubled in 1956 and is likely to be 10 million pounds yearly by 1965. Production of the reactor grade metal requires removal of the hafnium which the ore contains. In the manufacturing process, the basic raw material is zirconium tetrachloride. The hafnium is separated by solvent extraction. The wastes contain ammonia, mineral acids, thiocyanates, chlorides, sulfates, hexone and some mineral ions. Studies were made at one plant to observe the waste composition and the effect on the receiving stream. The most significant component is ammonia, which dissociates as ammonium ions in water to a higher degree as the pH increases. The plant studied was using two lagoons, separating strong process wastes from the more dilute housekeeping wastes. The former, after several weeks storage, were trucked to a disposal site where adequate dilution was available. The latter after prolonged storage were discharged to a stream. This method of storage and controlled dilution appears satisfactory because of the intermittent discharges and the opportunity afforded for neutralization by mixing acid and alkaline components. The possibility of recovering ammonia has been considered as has been chlorination of the wastes to destroy both the ammonia and cyanide.

"Wastes from the Production of Reactor Grade Zirconium." By R. C. Palange, C. Henderson, J. M. Cohen and G. N. McDermott. *Sewage and Industrial Wastes*, May, 1959.

Missile Manufacture Involves Plating

At the Martin-Orlando Co., missile plant in Orange County, Fla., the major source of liquid waste is the plating operation. This involves pickling with nitric, sulfuric and hydrofluoric acid; cadmium, silver and copper plating; anodizing, irradiating,

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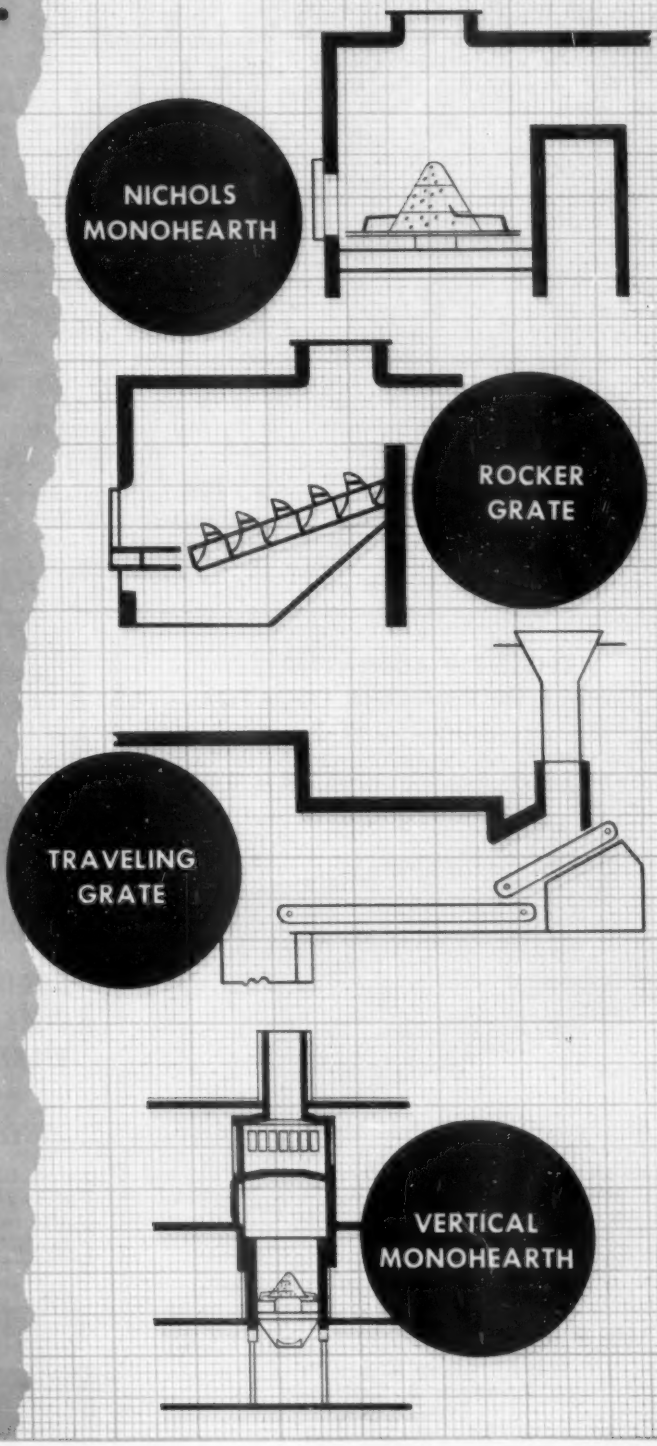

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chrome plating and chrome sulfuric acid cleaning. The rinses and concentrates from 120 process tanks are channeled into four drain lines according to characteristics of the wastes: 1) Alkali, 2) acid, 3) chromate, and 4) cyanide. The waste treatment plant is automated to the extent that all operating control is handled at a central panel. The cyanide destruction is by oxidation with chlorine and caustic, controlled by ORP measurement. The spent acid, alkali and chrome baths are treated together by neutralization and coagulation, using acid, lime, caustic, sulfur dioxide or coagulants, depending on composition of the waste being treated. Sludge is removed to a disposal site by truck. Both the cyanide destruction and spent bath treatment units are batch operated. Effluents are discharged to a vertical flow clarifier for further removal of suspended solids. The acid, alkali and chromium rinses are subjected to continuous treatment by neutralization. As yet there is insufficient concentration of hexavalent chromium in the rinse solution to warrant reduction of that ion. The plant features continuous sampling, level control, pH and ORP regulation of chemical feed, and continuous pH monitoring and recording. Cyanides in the effluent have been held to 0.5 mg/L; chromium, 1.5 mg/L; cadmium, 1.0 mg/L; and pH 7 to 8.5.

"Four Integrated Systems Handle Complex Missile Plant Plating Solutions." By C. Sweglar and R. Dvorin. *Industrial Wastes*, May, 1959.

Decontaminating Ocean Areas

The ocean, with its continuous movement and thermal gradients, presents difficult problems in radioactivity decontamination, and its high salinity and alkaline pH limit the use of common chemicals for precipitation methods. Laboratory experiments were made to determine the effect of spreading coagulating materials over a definite surface area of natural ocean water. Samples of water were contaminated with various fission products to give a 10,000 gamma c.p.m. Coagulating or decontaminating materials of various types were spread over the surface in the proportion of about 1400 tons per 2.5-mile diameter area. It was found that for mixed fission-product solutions, sodium silicate was the best decontaminant. For some products, the decontamination by sodium silicate was as high as 35 percent. By diffusing the silicate throughout the sample, 92 percent decontamination was achieved.

"Decontaminating Radioactive Ocean Areas Through Flocculation." By M. Honma and A. E. Greendale. *Industrial and Engineering Chemistry*, May, 1959.

Public Health and Air Pollution

Statistical analysis of the relation of mortality to air pollution in the United States was attempted for the period 1949 to 1951. An attempt was made to correlate disease mortality which could be related to air pollution with place of residence, with residence classified according to Bureau of Census definitions of metropolitan areas as distinguished from other urban and non-urban areas. It was recognized that fallacies in the analysis included lack of information on continuity of residence, on the relative periods of exposure, and on the accuracy of measurement of air pollution intensity and type. These and many other factors affecting mortality rates interfered with development of definite conclusions regarding disease incidence and air pollution. One striking result

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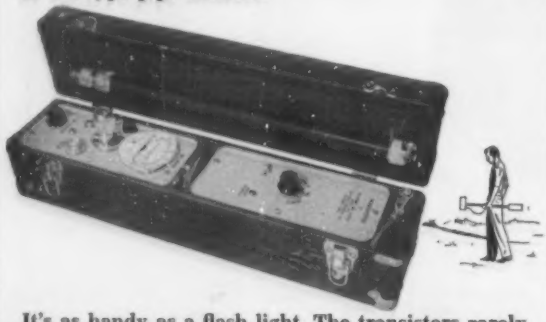

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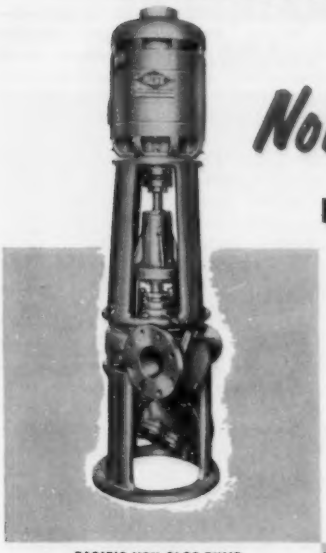

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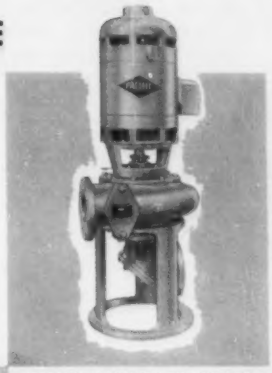

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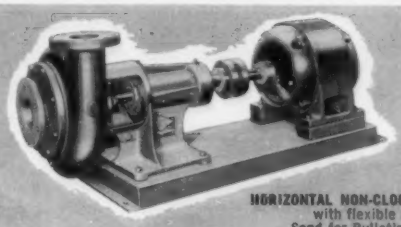

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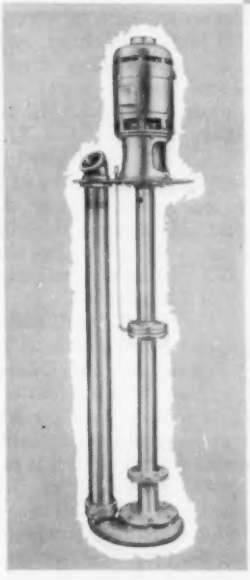

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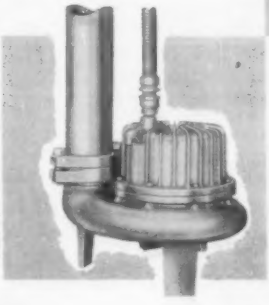

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was the sex differences in the distribution of the diseases studied, particularly the predominance of males having lung cancer. There is some evidence in support of the belief that a person with an impaired circulatory system may be rendered more susceptible to acute and chronic episodes of air pollution. It is believed that there are sufficient statistical relationships in the work to indicate the need for further research and study. Experimental epidemiology, toxicology and physiology with study of whole community populations for patterns of morbidity and of mortality will have to be undertaken before any clear-cut relationships between air pollution and disease can be established.

"Some Considerations in the Interpretation of Air Pollution Health Effects Data." By Richard A. Pringle, M. D., *Journal of the Air Pollution Control Association*, May, 1959.

Other Articles

"Disposal of **Radioactive Wastes** from Nuclear Power Reactors." By W. J. L. Kennedy. The general problem of reactor waste disposal is summarized, with discussions of various methods employed. Industrial Wastes May.

"Research in Developing Filters for Cleaning **Hot Gas Streams.** Part I." By L. Silverman, C. Kurker, Jr., and C. E. Billings. A progress report on particulate matter removal from furnace gases; Part I reviews the rotary screw agglomerator's ability to increase particle size and its efficiency as an iron oxide fume collector. Industrial Wastes, May, 1959.

"**Secondary Petrochemical Processes** as Waste Sources." By E. R. Wright, The more important petrochemical processes and their waste problems are considered, including processes using oxidation, chlorination, polymerization, alkylation of benzene, hydrogenation, nitration, and hydrocyanation. Sewage and Industrial Wastes, May, 1959.

"A Versatile High Flowrate **Tape Sampler.**" By J. S. Nader. Paper and glass air filters permit high air flow rates but are not compatible with analytical techniques. This article describes the development of a tape sampler using the type SM membrane filter. Journal of the Air Pollution Control Association, May, 1959.

"Treatment of Strong Organic Wastes by **Anaerobic Digestion.**" By A. E. J. Pettet, T. G. Tomlinson, and J. Hemens. A summary of work done, mostly in the United States, on digestion of industrial wastes, particularly packing house wastes with the comment that the methods might be applied in Great Britain. The Surveyor, May 2, 1959.

New Type of Sea Water Distillation Plant

A contract for a new type of sea water distillation plant, said to be capable of distilling fresh water from the sea at lower cost than previously achieved, has been awarded to Weir Ltd., Glasgow, Scotland. The new plant will be erected in the Sheikdom of Kuwait. It is the second to use the Weir "Multiflash" design. Scheduled for completion in 1960, the plant will cost $1.7 million and will have a capacity of 2.25 mgd.

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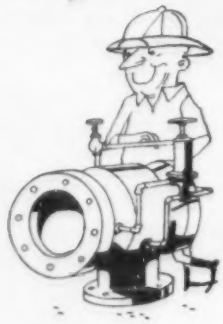

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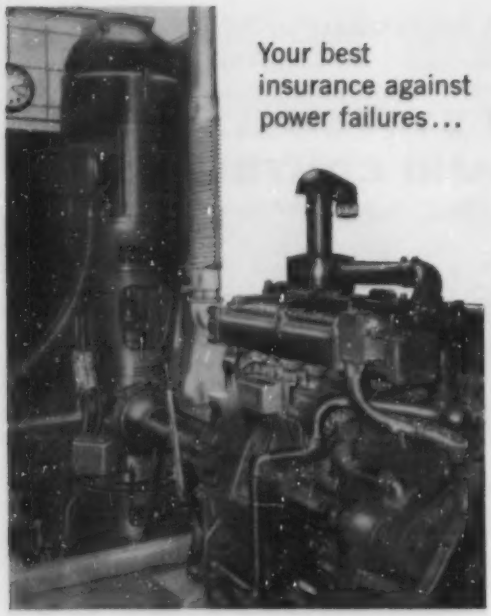

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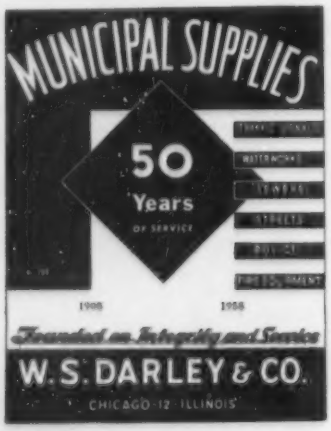

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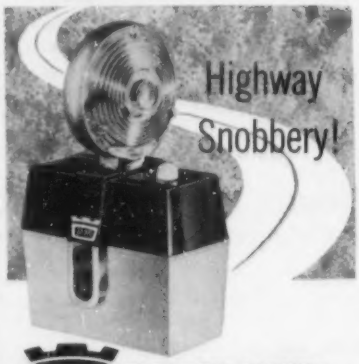

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Asphaltic Materials

(*Continued from page* 100)

faces and may even permit water to displace the asphalt that has coated the dry aggregate. Although the physical and chemical relationships that control affinity are extremely complex they may be altered by the use of wetting agents which may permit the use of hydrophillic aggregates.

Other factors of importance that affect adhesion include the fluidity of the asphalt, the surface texture and cleanliness of the aggregate. When an asphalt is quite liquid, it will readily flow over and come in intimate contact with the surface of an aggregate and attach itself thereon uniformly and firmly. If the surface of an aggregate is rough, as in a crushed aggregate, the asphalt can secure a firmer grip on the ridges and in the crevices than on the smooth surface of a gravel particle. It is obvious that a dirty or dusty aggregate will permit the asphalt to stick to the dust on the surface and not to the aggregate particle itself.

Uses of Asphalt Cements

Since asphalt cements are semi-solids at atmospheric temperatures, they are generally used in conjunction with hot plant mixes. In these mixes the AC is heated to about 300°F, the aggregate to about 325°F, in order to assure uniform distribution of the asphalt throughout the mix, to obtain good coating of the aggregate and to develop good adhesion between the AC and the aggregate. The asphalts should not be heated over 325°F, nor should the aggregates be heated over 400°F because excess heat will tend to harden the asphalt and adversely affect the durability of the mix.

Due to the tendency of asphalt to harden during storage, mixing and placing operations, and in aging under weathering and traffic, the trend has been toward the use of softer asphalts in these mixes. Generally 85-100 penetration AC is used for asphaltic concrete mixes with a trend toward 100-120 penetration and even 120-150 penetration AC. When the softer asphalt is used in these mixes a slight adjustment of gradation of aggregates toward a slight increase in fines is indicated, in order to obtain desirable densities. The use of softer asphalts appears to reduce cracking tendencies and provide better weathering of pavements.

Asphalt cements may and are being used in conjunction with bituminous penetration macadam bases,

pavements and seal coats. In such instances, soft AC's of 120-150 and 200-300 penetration are used. The AC must be hot, at least 325°F and the aggregate dry if good penetration and coating of the aggregate are to be attained. Asphalt cements of these grades may also be used for tack or prime coats under similar circumstances.

Road mix and soil stabilization operations normally do not lend themselves to the use of asphalt cements. Since an asphalt cement stiffens rapidly when it comes in contact with the cool material it is extremely difficult to obtain the desirable degree and uniformity of distribution of the asphalt throughout the aggregate or soil. If the AC is applied in the form of a controlled foam, it may be used readily for these purposes, especially when the aggregate or soil is wet.

The use of asphalt cements in paving mixtures has some distinct advantages over other types of asphalt. Since an AC sets and stiffens rapidly as the temperature of the mix cools, the pavement may be rolled almost immediately and opened to traffic as soon as it is cool. No aeration is necessary. Generally, hot plant mixes using asphalt cements will provide high type, heavy duty, durable pavements.

Cut-Back Asphalts

Cut-Back asphalts were developed to meet the need for an asphaltic material that was more liquid at atmospheric temperatures than asphalt cements. Cut-back asphalts are produced by dissolving asphalt cement in a variety of solvents in order to attain the desired viscosity.

The cut-back asphalts are classified as to type and grade. Standardization has established three types and six-grades in each type. The types are known as Rapid Curing or RC; Medium Curing, MC; and Slow Curing, SC. Each of the types have six grades, enumerated 0-5 as RC-0, RC-1, RC-2, RC-3, RC-4 and RC-5. Some effort is being made to reduce the number of grades in each type by further standardization.

The solvents used in the several types and grades are not specifically designated. Solvents or combination of solvents which yield the results required by the standard specifications, Tables 1, 2 and 3, may be used. Generally, however, gasoline or naphtha are used in the R-C, kerosene in M-C and light oils in S-C.

Although cut-back asphalts are called rapid, medium and slow curing, it does not necessarily mean

EXPANSION JOINTS ...
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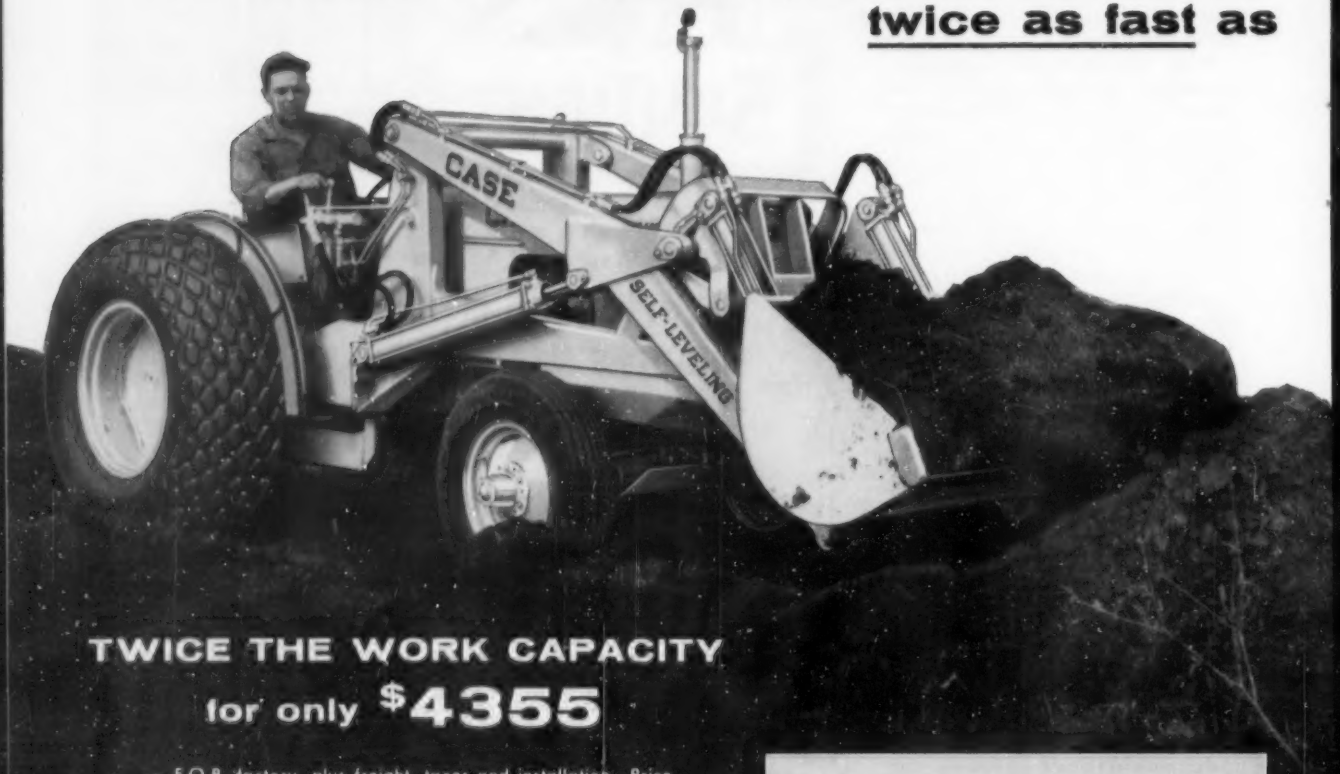

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that all grades of the RC will cure faster than any grade of MC. An MC-5 which contains about 15 per cent of kerosene may under certain conditions cure much more rapidly than an RC-0 which contains about 50 per cent gasoline. What the designations do mean is that the same grade in the RC-(RC-0) will cure faster than that in the MC-(MC-0). It also means that the curing rate increases as the grade number rises, for example an MC-5 cures more rapidly than an MC-0.

The viscosity of each similar grade, regardless of type, is the same at the same temperature and that the lower numerical grades are more liquid at lower temperatures than higher numerical grades. The types differ, however, in that the RC's contain a relatively harder base asphalt cement, 80-120 pen. than the MC which contains a softer base asphalt cement of 120-300 pen.

Uses of Cut-Back Asphalts

The uses of cut-back asphalts may best be discussed in relation to various forms of applications.

Dust Palliatives: In this instance the binder should be quite liquid so that it can readily penetrate a dusty surface and also remain soft for some time in order to hold the dust in place. Thus an SC-0 or SC-1 which meets these requirements would serve quite well for this purpose.

Prime Coats: Prime coats are used to densify and bond a porous or finely cracked surface. Consequently the asphaltic binder used must be capable of penetrating the pores or cracks in the surface. Depending upon the size of the pores or cracks an MC-0, MC-1 or MC-2 meets the requirements because they are quite liquid at atmospheric temperatures and set slowly enough to permit full penetration into the pores or cracks, and having penetrated they set fairly rapidly.

Tack Coats: Tack coats serve primarily to bond two layers of a pavement together. If there is no need of penetrating the surface of the lower layer the binder need only provide good adhesion between the layers and set rapidly so that construction may proceed without delay. If the surface is dusty, an RC-0 or RC-1 should be used because it is sufficiently liquid to penetrate and lift the dust and adhere to the surface of the lower layer. If the surface is clean and dry, an RC-3 or RC-4 or even a 150-200 penetration asphalt cement may be used for this purpose. If, however, the lower layer happens to be porous a prime coat should be used.

Penetration Macadams: In penetration macadam bases or pavements the binder used should possess sufficient body to hold the aggregates in place, be sufficiently liquid to penetrate the void spaces in the aggregate to the desired depth and set rapidly so that the pavement may be opened to traffic as soon as possible. Binders that meet these requirements are RC-4, RC-5 or a 150-200 pen. AC, provided the aggregates are dry. If the aggregates are wet, then a wetting agent should be used with these binders. A rapid set, high viscosity (RS-2) emulsified asphalt would work well with wet aggregates.

Seal Coats: Single layer seal coats, in which the aggregate is embedded in a layer of binder, require a binder that will adhere to the surface of the pavement, possess sufficient body to hold the aggregates in place and set rapidly. On a tight surface, RC-4, RC-5 and 120-150 pen. AC will serve well. On an open or porous surface, the surface should be treated with a prime coat before sealing.

Multiple layer seal coats, which are thin layers of a penetration macadam, require a binder that pos-

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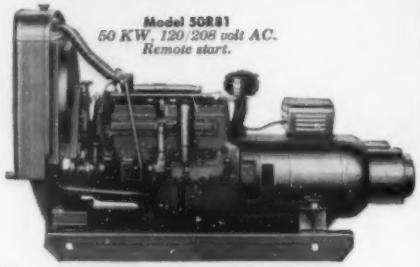

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sesses sufficient body to hold the aggregate together, liquid enough to soak into the voids of the aggregates and set rapidly. In conjunction with dry aggregates, RC-3, RC-4 or a 150-200 pen. AC would serve well. With damp or wet aggregates these binders should be treated with a wetting agent or an RS-1 emulsified asphalt should be used.

Road Mixes: The binder used in mixed in place road mixes depends largely upon the method of construction employed. If the mix are prepared by blade grader operations that require some time for mixing the binder used must remain liquid until the mixing and spreading is completed. In such a case an MC-2 or MC-3 would do very well. If the aggregate is damp or wet, a wetting agent should also be used with the MC-3 or the binder changed to an SS-2 emulsified asphalt. If the mix is prepared in a travel plant which does not require much time for mixing, MC-4 may be used advantageously. If the aggregate is wet an MS-2 emulsified asphalt should be considered.

Cold Laid Plant Mixes: Mixes prepared in stationary plants that may be stored for a short period of time before laying, or are laid at lower mix temperatures, require a binder that will mix readily with the aggregates and set comparatively slowly. For mixes to be stored an MC-2 or SC-2 may be used. For those laid at cool temperatures, MC-3 will serve. If damp aggregates are used, an SS-2 emulsified asphalt may be substituted.

Emulsified Asphalts

Direct emulsified asphalts, asphalt dispersed in water, are in common use and have been classified as RS, rapid set, MS, medium set and SS slow set, with grade 1 and 2 in each class indicating high or low viscosity respectively. The indirect or inverted emulsified asphalts, water dispersed in asphalt, although gradually coming into more extensive use, have not as yet been classified.

Direct emulsified asphalts usually contain up to 45 percent water, have a furol viscosity of about 20-100 seconds and use a base asphalt cement having a penetration of 100-200 except the SS-2 which uses a 40-90 pen. AC. They are all quite liquid at about 77°F; however, high viscosity grade may have to be heated to 150°F for more efficient results. Heating emulsions over 180°F may cause them to foam; while freezing will separate and break the emulsion. Emulsified asphalts are chocolate-brown in color

"On the New York State Thruway . . .

WE SAVED 50% IN LABOR AND MATERIAL COSTS . . . WITH BERMICO PARQUAY CONDUIT"

James Owens, Installation Foreman,
Domizio & Evarts, Inc., Yonkers, N. Y.

General view of New York State Thruway

"Installing Bermico ParQuay Conduit along the Thruway was easy," commented Mr. Owens. "This direct burial conduit is the ideal conduit for roadside use. No concrete encasement is necessary. We just laid six or eight lengths in the excavation trench at a time, quickly joined them using fibre couplings, then backfilled with clean fill."

"Where lengths had to be especially cut and fit," went on Mr. Owens, "we used a portable hand tooling machine, and we cut our coupling time 1/3 . . . compared with metal thread joints required by other types of conduit."

Bermico ParQuay (pronounced parkway) Conduit is simple to lay. It is made from special cellulose fibre, impregnated with coal tar pitch. Each 8-foot length is precision engineered, with smooth inside bore to allow easy cable pull-through without abrasion. It is long-lasting . . . extremely resistant to acids, alkalies, heat, water and corrosion. Try Bermico ParQuay Conduit on your next street or runway lighting job, or wherever direct burial conduit may be utilized.

Distributed by WESTINGHOUSE Electric Supply Company and Agent Jobbers.
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8-foot lengths of Bermico ParQuay Conduit being quickly assembled in excavation trench.

Unloading Bermico from truck. So light, up to 6 lengths of Bermico can easily be handled by one man.

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and turn black when they break and begin to set.

Uses of Emulsified Asphalts

Excellent results can be obtained with the use of emulsified asphalts, if they are properly used and applied. By virtue of their character and the various types of emulsifying agents used, they have some unusual properties. They are more liquid at 77°F than other asphaltic binders, and therefore can penetrate more deeply and coat aggregates more effectively. They also appear to possess a higher affinity for aggregates and can displace water from the surface of an aggregate, making them useful in conjunction with wet or somewhat hydrophillic aggregates Thus they may be effectively used with damp or wet aggregates in road mix, soil stabilization, penetration macadams, seal coats and cold mix operations. They are not used with hot mix operations.

The success or failure of a bituminous mixture in service depends largely upon the extent to which known facts regarding the properties and characteristics of the aggregates and the binder have been utilized. Know your materials and select them intelligently to conform to the specific construction or mixing methods, looking toward the particular service the pavement must perform and the worrisome failures will disappear.

Citizens and City Share Cost, Traverse City, Mich., Gets a

RELIGHTED BUSINESS STREET

THE ABILITY of modern streetlighting systems to display municipal business districts to best advantage is shown effectively in these night scenes of Front Street in Traverse City, Michigan. Taken under identical conditions but three months apart in time, they show the improvement along a 1½ mile thoroughfare after a 30-year old incandescent system was replaced by Westinghouse OV-35 luminaires and 21,000-lumen BH-17 mercury vapor lamps. The new mercury vapor system eliminates the earlier "lighted-tunnel" effect, so that signs and upper stories of business properties are now visible at night. In addition it provides a proper light balance between sidewalk and street surfaces.

The relighted Front Street is the joint achievement of two city agencies, the City Commission and the Chamber of Commerce. The need for relighting and a plan for carrying it out were first broached by City Manager N. G. Damoose to the Chamber of Commerce. The Chamber endorsed the plan and arranged for the proposal to be carried to the public and to property owners by a special streetlighting committee. Both groups responded with formal petitions that the relighting program be undertaken. Property owners undertook to pay 70 percent of the cost of the $55,000-dollar installation. The city underwrote the remaining 30 percent.

After final approval of the program by Traverse City's City Commission, the City Light and Power Department began installation of the equipment. Just over three months later, the full complement of 188 OV-35's luminaires was mounted on 30-foot Kerrigan Weldforged standards and wiring was complete. Since turn-on ceremonies, reaction of the community to the new system has been so affirmative that Traverse City officials are now investigating extension of mercury vapor lighting into residential areas and to other major roads, such as, the two miles of Bay Shore Boulevard which has already been beautified and landscaped.

● **BEFORE** the relighting program, incandescent lamps mounted in old-fashioned luminaires provided plenty of glare but left the street surface relatively dark.

● **FRONT STREET** in Traverse City, Michigan, as it looks after installation of the mercury vapor system. The light balance on street and sidewalks is excellent.

Greenville, Miss. Cuts Costs . . . Improves Refuse Collection with DUMPMASTER

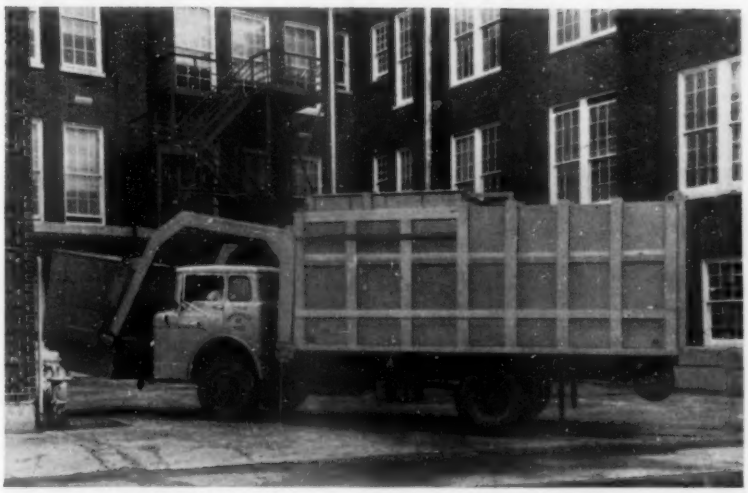
Officials, Merchants Enthusiastic Over New Type Service

After five months of operation, Greenville, Mississippi officials, merchants and sanitation department employees believe their DEMPSTER DUMPMASTER system is the answer to low-cost, sanitary refuse collection.

This prosperous, progressive city on the banks of the Mississippi River installed one truck-mounted Dumpmaster and 39 containers in sizes ranging from three through six cubic yards in February of 1959. Five months later, City Engineer John Teunisson who, together with a far-sighted city council instituted the installation, reports that the new system has exceeded his highest expectations for economy and efficiency.

Members of the Sanitation Department who have closely supervised operation of the new equipment are particularly pleased with the Dumpmaster's ability to handle big capacity containerized refuse, as well as hand-loaded residential pickup routes. It is pointed out that this flexibility enables them to keep the equipment busy, thereby saving the taxpayers money.

John Teunisson, veteran city official, likes Dumpmaster economy.

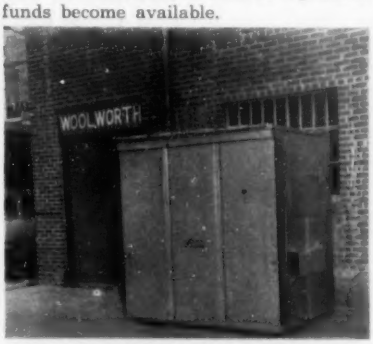


Dumpmaster picks up 6 cu. yd. container behind elementary school.

Schools and Downtown Areas Containerized Residential Routes Served By Dumpmaster

At present, schools and the downtown business district, where large volumes of refuse accumulate, are served by big capacity containers, with all 39 locations being given daily service. Additionally, several manual loading routes in residential areas are served by using the Dumpmaster as a conventional packer truck.

City Engineer Teunisson estimates that the school containers will pay for themselves in less than one year as a result of time savings with the new system. The Dumpmaster has made possible a $7,000 reduction in the Sanitation Department Budget. The size of these savings and opportunities for further improvement have led Greenville to set up a goal of over 100 containers as soon as expansion funds become available.



Typical installation behind a store in the downtown business district of Greenville.

Tax-Fee Plan Covers Expenses

Greenville's residential and school refuse collection is tax supported, but commercial refuse carries a charge to the merchant based on the time necessary to make a pickup with a conventional packer truck and its crew. The monthly charges are based on the number of pickups, times the number of minutes required, times $2.75 per minute. These proceeds are applied to pay for the container, the Dumpmaster and the operator's salary. Because of the high speed collection, the city saves enough over manual operation to offer free service to any merchant who purchases his own container.

Dumpmaster dumps huge load at the efficiently operated landfill.

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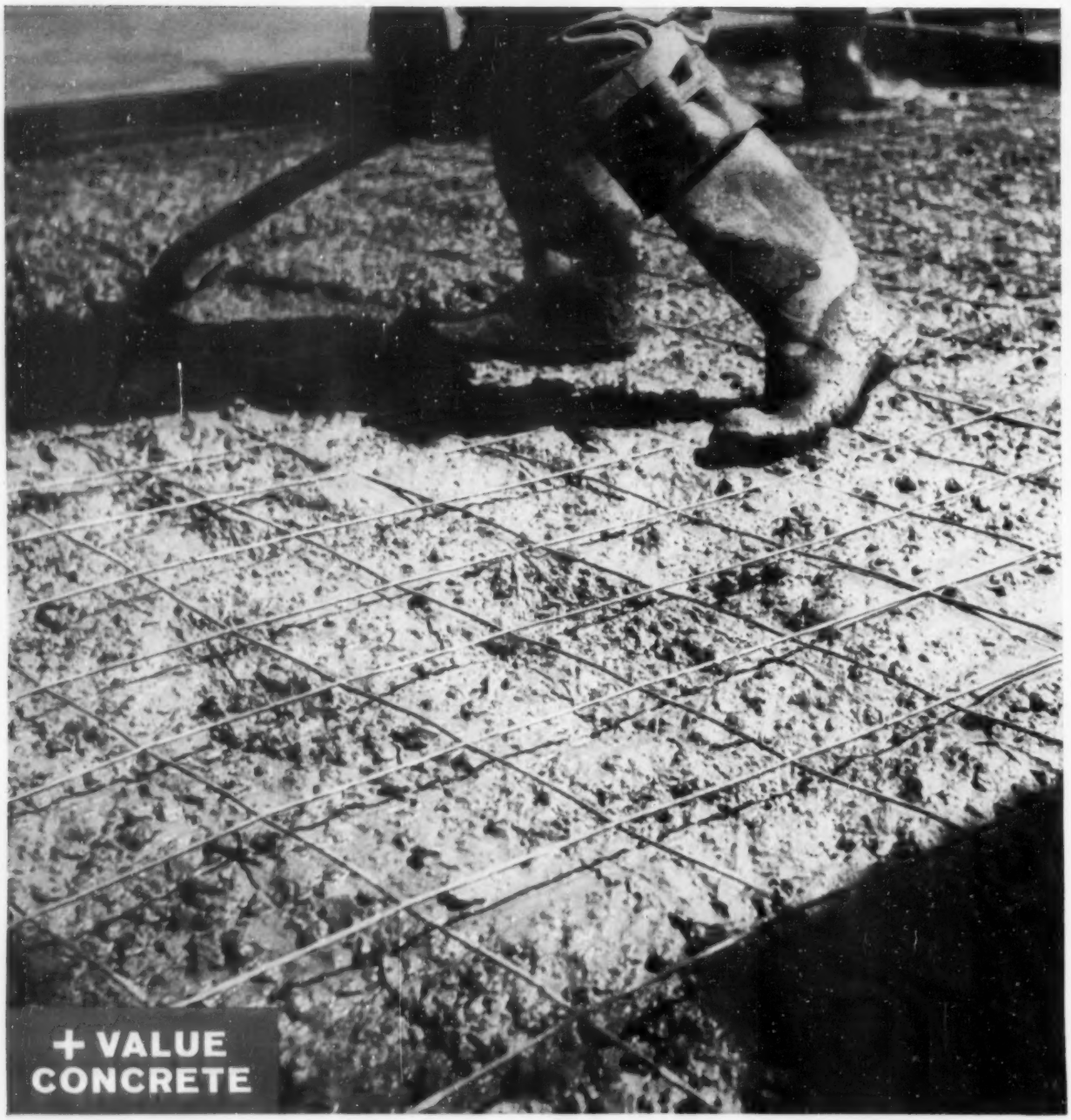
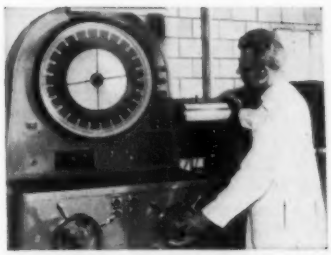
New, improved (USS) American Welded strength of 75,000 psi...and a



Wire Fabric has minimum tensile minimum yield point of 60,000 psi...

to give you a better, stronger product at no increase in cost!



For more than 50 years, USS American Welded Wire Fabric has been doing an outstanding job of reinforcing all kinds of concrete work—from porches and walks to skyscrapers and highways. And now—because of its greatly increased tensile and yield strength—it will give even greater strength, longer life, increased freedom from cracking and less maintenance. Also, it will permit longer joint spacing for reinforced slabs on ground or less steel if present joint spacing is used. The new improved Welded Wire fabric will have a 75,000 psi minimum ultimate tensile strength with a minimum yield point of 60,000 psi.

Closely controlled laboratory tests show that if the conventional bond stress theory is applied to American Welded Wire Fabric's resistance to slip, fantastically high bond stress values of from 1,000 psi to 2,700 psi are computed. (See ACI Proceedings, Vol. 48, April, 1952.) Continuing bond test research under the direction of American Iron & Steel Institute has shown such good mechanical anchorage in the concrete as to permit this increase in the Tensile Strength of Fabric. American Steel & Wire is able to present this new product because of the tested bond values which enable designers to take advantage of a higher fabric yield point.

Just one example of the advantages of this improved fabric is in one-way slabs. The ACI Building Code 318-56 will allow unit tensile strength for fabric in main reinforcement of 30,000 psi in one-way slabs of 12-foot span or less, provided reinforcing members are ⅜" or less. Previously, designers were limited to 28,000 psi working stress with fabric, and only 20,000 psi with intermediate grade bars.

The new Welded Wire Fabric will cost no more. It will come in the same prefabricated rolls or sheets for easy handling and placing. Therefore, to get the improved product on your job at no extra cost, be sure to specify USS American Welded Wire Fabric.

USS American Welded Wire Fabric is available in a wide variety of styles, sizes, lengths and widths . . . in wire gauges from ½" diameter to 16 ga., and in longitudinal and transverse wire intervals of 2" to 16". Steel areas for all normal structural reinforcing in all types of construction are readily available. For more information on USS American Welded Wire Fabric—and its new tensile strength—write to American Steel & Wire, Dept. 989, 614 Superior Avenue, N. W., Cleveland 13, Ohio.

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United States Steel Export Company, Distributors Abroad

Always ask, *"is it Reinforced"*

New Developments in CONSTRUCTION EQUIPMENT

This is the concluding portion of a paper presented at the 1959 Ohio Engineering Conference. In his introductory remarks, published last month, Mr. Radzikowski pointed out that our present expanded highway program has been made economically feasible by greatly increased machine productivity, which has helped to offset higher costs of labor and materials. Here are details of a number of new developments which show the potentials of today's machines.

H. A. RADZIKOWSKI,
Chief, Division of Development, Office of Operations, Bureau of Public Roads

There have been a number of new equipment developments in the field of embankment, subgrade and base compaction as well as in the area of flexible pavement compaction. The newer developments fall into four broad categories:

1) Segmented pad rollers.
2) Dynamic compactors (both shoe and roller types).
3) High pressure pneumatic tire rollers.
4) Grid rollers.

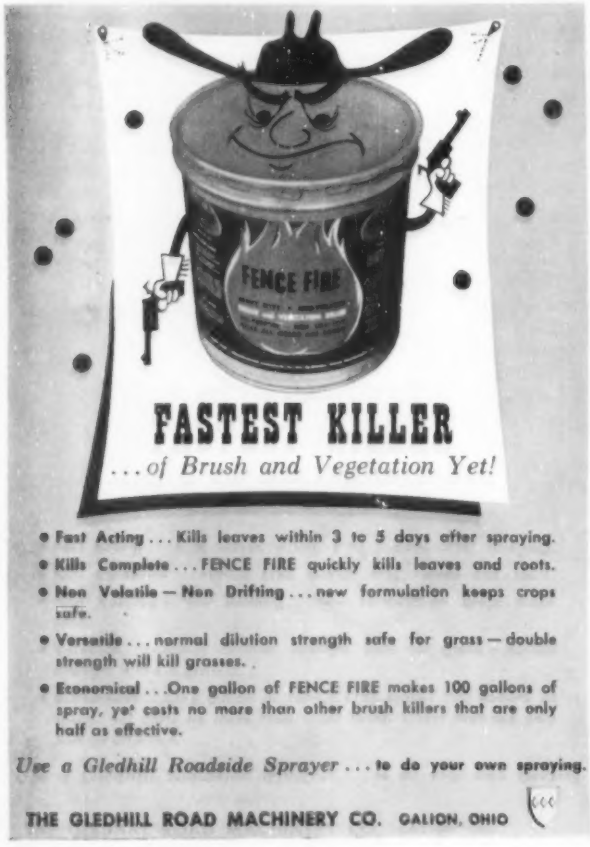
The segmented pad type includes both the functionally designed machines and the compactor wheel attachments to wheel type tractors. The segmented pad rollers function best in the fine grain soils where tamping rollers are normally used. In addition to high speed compaction another reported advantage to this type is its ability to keep the surface of embankments well sealed against the entrance of water and thereby permit early resumption of grading operations after a rain.

Dynamic compactors of both the shoe and roller types have been used successfully for a number of years in compacting granular materials. The shoe types have proven their value, particularly in macadam base construction where relatively thick layers (6 to 9 inches) have been placed in a single course.

An American manufacturer has recently introduced a self-propelled vibratory roller of a size that may be used on base and flexible pavement construction. The driving roll is 42½ inches wide with vibrating frequency variable up to 2200 vpm. The same manufacturer has also introduced a meter for measuring the resonance frequency of materials being compacted. Resonance frequency indicates the rate at which the most effective and economical compaction can be achieved.

Perhaps the most recent trend in compaction equipment design is the introduction of both static and vibratory compacting principles in the same unit. One of the newer developments is a 3-wheel roller with vibration on the middle roll. The vibratory roll is retractable which will allow the roller to be used as a 2-axle tandem unit. Last year this roller was used successfully in several States for compacting base courses in lifts up to 9 inches.

Another compactor combination is a 3-wheel roller with trailing shoe type vibratory compacting units which has demonstrated its ability to obtain densities in base course construction which could not be achieved with the static roller by itself.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Dual rollers, having both pneumatic and steel wheel rolling units which can be used either individually or together, are now available with impact type vibration on the steel roll at the operator's option. This provides for three types of compaction action, if used individually, and two combinations when used together. Based on the successful application of these machines the manufacturer is introducing another model which incorporates scarifying, pulverizing and leveling in addition to the compacting units furnished on other current models. A scarifier has been added to the prime mover and a rotary mixer inserted near the center of the towed unit. A grader blade is interchangeable with the scarifier attachment.

A significant development in the compaction of base courses and flexible pavements has been the high-pressure pneumatic smooth-tread compactor tire. It is now possible to exert contact pressures from 80 to 100 psi with pneumatic rollers during construction. This is a range which will exceed that imposed on the surface or base by the concentrated loads of heavy truck tires, including those which conform to legal axle loads.

There is a need for a new rating criteria for pneumatic rollers, based principally on their ability to exert a range of contact pressures on the surface. For example, pounds per square inch (psi) of contact pressure is much more indicative of compacting ability than the commonly used "pounds per inch of tire width." There is also a need to revise construction specifications in order to eliminate obsolete and restrictive requirements so that the advantages of high pressure pneumatic rolling can be realized.

Compaction of flexible bases and asphaltic concrete surfaces with pneumatic rollers equipped with high pressure compactor tires will largely eliminate post construction densification under traffic which may cause permanent deflection in the wheel tracks. The Ohio State Highway Department has been one of the pioneers in advocating the use of high pressure pneumatic rolling for the densification of asphaltic concrete pavements.

Grid rollers are not a new compacting device, but some new models have been introduced recently, including a 2-drum self-propelled model. This dual drum unit, which employs grid rolls as the driving wheels of a 4-wheel tractor, has operating speeds of 5.5 to 15.3 mph.

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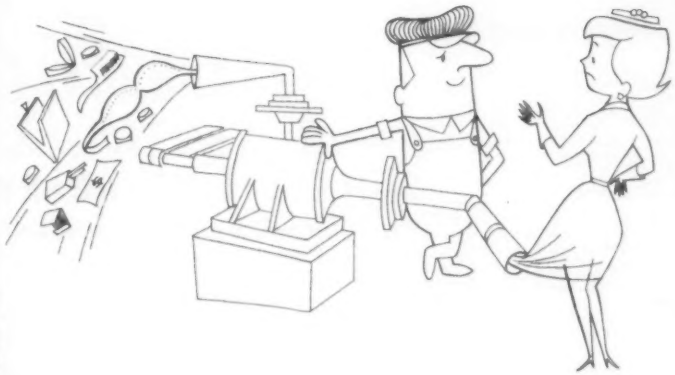

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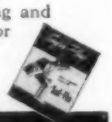

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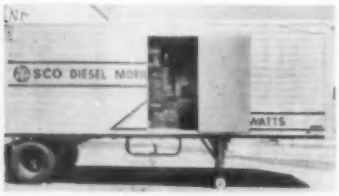

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Concrete Paving

The modern slip form paver is a relatively new development in the concrete paving field. It is essentially a single-pass machine which combines spreading, vibrating, tamping, finishing and belting in a single-pass operation and, in addition, hauls its own forms into which a ribbon of dense concrete is extruded. The stability of the newly poured concrete prior to initial set is due to the simultaneous application of vibration and compression to a closely controlled harsh mix.

The one-man-operated slip form paver not only eliminates the forms and the equipment and manpower for setting and pulling the forms, but also such single equipment items as spreaders, transverse finishers and longitudinal finishers, all of which require individual operators. The slip form paver has been used successfully on both concrete base and finished pavements. Savings on pavement costs are in the range of $0.40 to $0.50 psy or up to $7,000 per mile of a 24-ft. slab.

As an indication that riding quality is not being sacrificed by the slip form method, it might be mentioned that an excellent smoothness (80 inches per mile when measured by the Bureau of Public Roads roughometer) was obtained on a finished non-reinforced concrete pavement placed on a soil cement foundation. This smoothness compares favorably with the smoothness of pavements constructed with carefully placed forms. Here again it seems that an electronic device for controlling longitudinal profile automatically would make it possible for the slip form paver to build pavements with even better riding qualities.

A method has been devised by a Colorado paving contractor for incorporating wire mesh reinforcement into the newly formed slab in the single-pass operation. An experimental section of 24-ft. concrete paving one mile in length was laid on Interstate Route No. 25 near Denver, Colorado. To meet this placement requirement the contractor developed a sled-type device which was attached to the

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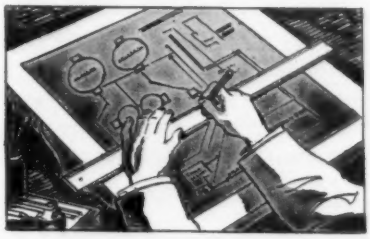

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forward arms of the slip form paver.

As the slip form paver moved forward at speeds of 3 to 5 fpm, the sled device lifted the mesh up from the grade and on to the sled runners. The concrete was then dumped from the paver bucket in front of and close to the strike-off blade of the slip form paver, and as the strike-off blade moved forward it pushed the concrete ahead and down through the mesh. After this, and at a point where the sled runners had moved ahead from in under the mesh, the regular vibration, tamping and extrusion of the concrete took place, in the same manner that the slip form paver operates without mesh.

Placement of reinforcement, both in conventional concrete pavements and in the newer continuous reinforced types, could be improved if present manual methods could be eliminated. It is understood that an equipment manufacturer is currently developing a device for the mechanical placement of longitudinal reinforcing bars in continuous reinforced concrete pavements.

The increased placement of 24-ft. wide slabs both in slip form and conventional type concrete pavements introduces a problem of placing the transverse tie bars. Several devices have been developed to assist manual placement, but only recently an attachment to a spreader was developed on the West Coast for the automatic placement of tie bars. The bars are held in a horizontal position above the subgrade in a rack or magazine and placed individually at predetermined intervals with hydraulic actuated controls.

The California Division of Highways has been using a positive action type tamper for a number of years in processing paving concrete. Several new models were developed in the last 3 to 4 years as attachments to finishers, and their use is becoming more widespread. The tampers do not replace the pan type vibrators, but supplement them in consolidating concrete. The positive displacement furnished by the tamper provides additional force and depth over that derived from the conventional types having the tamper unit mounted on springs. The positive action tampers permit the use of drier mixes, particularly those containing crushed aggregates, facilitating final finishing.

There has been an increase in the volume of ready-mixed concrete, both from central plants and

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truck mixers in the postwar period. Available information indicates that over one-half of the States are using this method of processing materials for concrete paving construction. In one urban State the ready-mix yardage comprises about 75 percent of the total volume of paving concrete. All indications point to a further increase in ready-mix paving concrete.

Two factors undoubtedly could have a considerable influence on the magnitude of increased use of off-site mixing: 1) the large volume of concrete paving generated by the expanded highway construction program, and 2) improvements in features of present ready-mix practice, particularly in the transit-mix industry, with respect to paving concrete, which are now under way. The equipment used in the transit-mix industry varies to a considerable extent in design, and an effort is being made to have it maintained more closely to the standard normally demanded of equipment used by highway paving contractors.

New developments in controlling the uniformity and slump of central plant mixed concrete seem to point towards an accelerated use of this method for concrete paving if problems associated with hauling and depositing can be overcome. Not only are highly sensitive moisture meters available which can determine moisture content in individual batches, but in addition a device has been developed which will automatically control the slump of concrete without regard to the variation in moisture content of the aggregates. The operation of this device takes into consideration the fact that the torque required to turn the mixer varies with the slump.

There is also the problem of segregation in discharging, particularly when dumping is employed. This latter problem can be solved to a great extent by employing some kind of spreading equipment to receive and place the ready-mix discharge.

Last year a new model of a spreader for receiving ready-mixed concrete made its appearance on several concrete paving jobs, including some Ohio projects. This unit has a bottom discharge spreader bucket which operates on transverse runners from which it can be in position on either side of the forms for loading. Upon loading, the bucket is moved transversely across the subgrade while placing a predetermined thickness of concrete which can be controlled from the bucket opening. Normally the bucket is returned to the loading

side after the spreading pass. Placement of the concrete can be retarded, stopped or started at any point. As the spreader moves forward, the adjustable strike-off screeds the concrete longitudinally. All movements of this new spreader are hydraulically powered.

Another conveyor belt model which has been used during the last 5 years is undergoing extensive improvements by a new owner. A pilot model now in use shows great promise for the efficient spreading of concrete received from transit trucks or dump bodies. It is capable of handling a 20 to 25-ft. slab of either single or two-course construction. Two longitudinal conveyors which use the steel forms as a track are located in front of and behind a third transverse conveyor mounted in a cross frame. The longitudinal conveyors are capable of receiving two truck loads of concrete simultaneously.

Bridges and Other Highway Structures

Auger drills are now capable of doing the complete excavation job for 3-ft. diameter pier columns having belled footings of 7-ft. diameters. Automatic welders which operate at constant speed and perform any desired type of welding between fixed limits are now used extensively for processing foundation piles and for erecting structural steel.

Another improvement in welding technique is the use of nuclear energy in the testing of welds. This radiographic inspection is made possible by the use of cobalt as the source of gamma radiation.

Special concrete finishers have been developed recently for the pouring of concrete deck slabs in widths varying from 24 to 44 ft. with crown adjustment up to 6 inches.

Another device, which is finding considerable favor with bridge contractors, is a monorail conveyor system by which concrete can be transported rapidly from the mixer and dumped at the point of placement on either side of the track. The unit, which does not require a driver, can also be used to convey reinforcing steel, lumber and fabricated forms.

The standardization of prefabricated beam designs by a western State has encouraged contractors to obtain permanent forms. The repetitive use of permanent forms results in savings both to the contractor and the taxpayer while at the same time conserving valuable materials.

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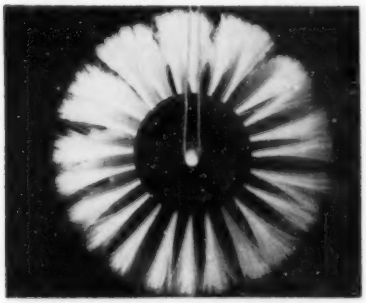
EQUIPMENT NEWS

Nylon Pick-Up Broom Filament



Rynal core filled with DuPont Tynex

Rynal Corp. brooms are now offered with DuPont's Tynex nylon filament. It permits fast installation, eliminates any lack of uniformity and assures perfect balance. Maximum efficiency and longest possible wear results without waste. More data from Rynal Corp., 114 St. Joseph St., Arcadia, Calif., or circle **No. 7-1** on the reply card.

Bulk Refuse Collection System

City Tank Corp. announces a new bulk refuse collection system. Based on a newly developed container called Roto-Can, the method consists of a lifting and tilting device that stresses simplicity and safety. In actual operation, the Roto-Pac truck merely backs up to the Roto-Can, hooks on, then with a touch of a lever, the container is lifted, tilted, dumped and settled back on the ground. It is one-man operated and safe. The Roto-Pac collection truck can be used as a manually loaded refuse truck when not on container service. There are four sizes of Roto-Cans available—from 1½ to 6 cu. yds. More details from City Tank Corp., Corona, N.Y., or circle **No. 7-2** on the reply card.

Refuse collection system can handle mixed routes and all forms of refuse

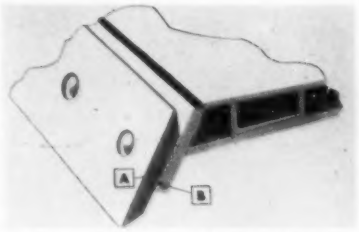
Rotary Mowers on IHC Tractors

IHC has just announced it is offering four heavy-duty, center-mounted, International Danco rotary mowers for use with the International Cub Lo-Boy and the Farmall Cub, as well as the Farmall 240, 340 and 460 models. The mowers cut swaths ranging in widths from 58 to 94 ins. and have cutting heights of from one to 12 ins. above the ground. The heavy-duty mowers combine stability with ruggedness. Center mounting provides compactness for good tractor maneuverability and results in a low center of gravity, enabling the tractor to mow safely on steep slopes; the tractor will slide, instead of tip. Four-point level lift through parallelogram linkage accurately controls cutting height adjustments Complete details from Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 7-3** on the reply card.

Tractor-Drawn Scraper

Scraper for use with a Cat D8 or D9

A new crawler tractor-drawn scraper, offering increased capacity and greater flotation has been introduced by Caterpillar. Designated the No. 463 Series C scraper, the unit can be used with either D8 or D9 tractors, without modification. Struck capacity is 22 cu. yds. and heaped capacity is 29 cu. yds. The push block is stronger and more rigidly attached to the bowl. New one-piece guide struts eliminate many weld joints and connect the push block directly to the bowl bottom. For more details write News Service, Caterpillar Tractor Co., Peoria, Ill., or circle **No. 7-4** on the reply card.



Unworn surface A of the double bevel section is mounted against surface B

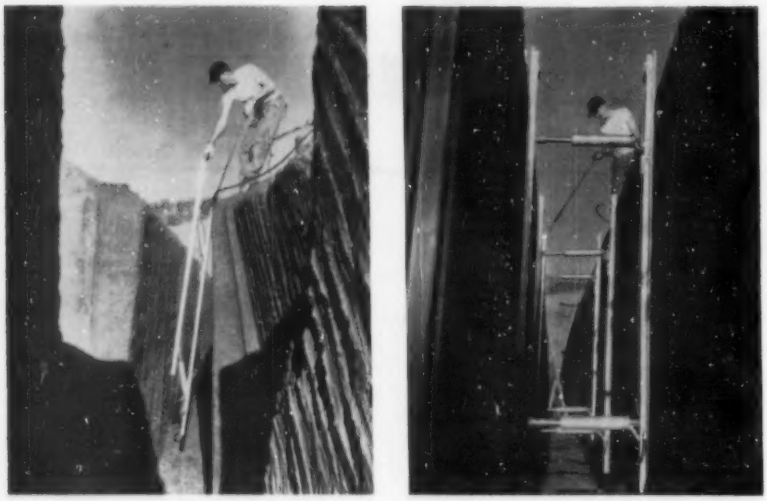
Bucyrus Blades ForgeTemp Cutting Edges

New design ForgeTemp double bevel dozer and scraper cutting edges have been announced by Bucyrus Blades. Three advantages of these blades are as follows: 1) The ForgeTemp double bevel design assures equally firm, stable mounting of the cutting edge in both original and reversed position; 2) the new design also eliminates abrasion wear to the blade base or moldboard; and 3) the bevel angle of the ForgeTemp blades provide more material for wear and extends service life. The cutting edges are available in special design for unusual applications. Sectional design cutting edges for bulldozers can also be supplied. For complete information write Bucyrus Blades, Inc., Bucyrus, Ohio, or circle **No. 7-5** on the reply card.

Sod Cutter

A new foot operated sod cutter is introduced by Jay-Bar Mfg. The cutter is of all-metal construction to withstand rugged, maintenance-free service and is designed to cut sod easily and accurately 12 in. wide without ripping, tearing or breaking the sod. Three cutting depths can be obtained by pre-adjusting the cutting blades. A relief gap between the blades prevents binding to assure ease of cutting. It also features a ballbearing surface roller guide which maintains an even depth for the blades to cut beneath the sod. For further information write Jay-Bar Mfg. Co., P. O. Box 5031, Harper Woods 36, Mich., or circle **No. 7-6**.

Trench Shoring Device for Sewer Construction



Ease of installation and safety features of the Saf-T-Jax shoring device are shown

A new device which permits faster and safer trench shoring on sewer and other excavation jobs is announced by Sigma Engineering Corp. The device, called Saf-T-Jax, is a strong, integrally operated unit consisting of two opposing aluminum shoring members which are separated and supported by hydraulic jacks. The units are designed so that one workman standing at the top of the trench can easily install them directly behind the digger. They also are retracted from the top of the trench and fold together into units only 5¼ ins. thick for handling and storage. Two models, a unit with 2½-ft. long shoring pads and a 7-ft. unit, are available. Both are equipped with 8-in. wide extruded aluminum alloy shoring members. The shoring pads are connected together by hydraulic cylinders which will brace trenches 20 to 28 ins. wide. When extension rods are used, ditches as wide as 70 ins. can be shored with no loss of safety features. More data from Sigma Engineering Corp., 990 North Tenth St., San Jose, Calif., or circle **No. 7-7.**

Eliminate your Rust Problems with Rust-Cure

Rust-Cure is the Monroe Company's answer to rust. Rust-Cure goes on right over the rust by brush, spray or dip and one application is usually sufficient. It penetrates through rust particles and has a natural affinity to the metal surface beneath the rust. It is available clear or in colors—red, aluminum, green, light gray and black. Complete details from The Monroe Co., Inc., 10703 Quebec Ave., Cleveland 6, Ohio, or circle **No. 7-8** on the reply card.

60 KW Diesel Generating Plant

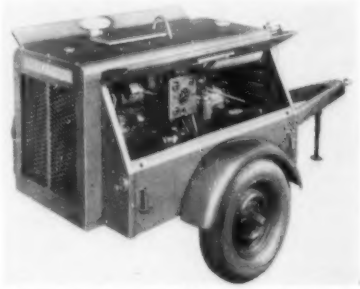
The development of a new 60-KW diesel electric generating plant has been announced by Jeta. A new addition to Jetapower line of electric plants, the 60 KW unit, Model CD-6018, is a unitized three-phase, 60-cycle set, with an output of 120/208 volts AC. The unit has a speed of 1800 rpm developed by a water-cooled six-cylinder diesel engine. Standard equipment includes 24-volt electric-starting and battery-charging systems. Complete data from Jeta, Inc., Yonkers, N.Y., or circle **No. 7-9** on the reply card.

Flat Bed Body Crew Truck

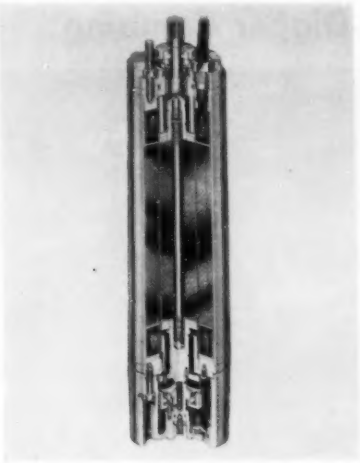
The series FC flat bed body with its own crew compartment is widely accepted for use in a number of allied and diversified fields including tree trimming for labor crews in the electric, gas and water industries as well as in highway bridge work. The crew compartment accommodates four men comfortably and the basic body is furnished in two styles. The first with a crew cab offset to provide space for carrying pole derricks, 20-ft. lengths of pipe, wooden beams and other long material. The second has a vertical compartment section immediately to the rear of the crew compartment with both sides equipped with adjustable shelves and rope hooks. Coupled with the basic compartmentation is a full flat bed loading space. For further information write Utility Body Co., 1530 Wood St., Oakland 7, Calif., or circle **No. 7-10** on the reply card.

Low Engine Speed Single-Stage Rotary Compressor

Economy of operation and maintenance are said to be the outstanding characteristics of Worthington's new 85-ft. Super Blue Brute single-stage, portable air compressor. Lower speed operation reduces wear, and engine life is further extended by a clutch which permits warm-up without load. In addition, the 168-hp Continental gasoline engine has a reserve power capacity of over 50 percent. The unit has discharge pressure settings of from 75 to 125 psi. Designed for heavy duty operation, it need not be set level as it will perform satisfactorily on moderate slopes. Wide-track wheels, corresponding to those of most trucks, and a low center of gravity, permit safe towing at high-speeds, even over rough, rutted terrain. For complete details write Worthington Corp., Holyoke Div., Holyoke, Mass., or circle **No. 7-11** on the reply card.



Shown is the Worthington Blue Brute 85 cfm single stage rotary compressor



Cutaway view of the submersible motor

Submersible Motor

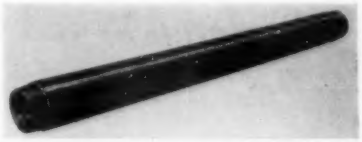
Louis Allis has announced production of a new 4-in. submersible motor, designed to drive deep well turbine pumps in domestic and industrial water supply applications. Ratings offered in single phase construction are from 1½ to 5 hp. In three phase construction, ratings extend from 1½ to 7½ hp at 3550 rpm. Shaft height on the motor can be adjusted to center pump impellers for optimum pump efficiency. An exclusive design feature on the adjusting mechanism prevents overadjustment that could damage the motor. For complete corrosion resistance, bearing brackets are of cast iron, the thrust bearing is stainless steel and all other exposed parts are either stainless steel, brass or neoprene. Complete details from Louis Allis Co., Dept. P, Milwaukee 1, Wis., or circle **No. 7-12** on the reply card.

Concrete Vibrators

Champion Mfg. has announced two one-man vibrators, a flexible shaft model and a motor-in-head model. The flexible shaft vibrator, with a 1½-hp electric motor, features a twin variable eccentric that allows for variation of amplitude (width of vibrating motion) and frequency (speed of vibrating motion) according to job requirements. The motor-in-head vibrator features an easily removable motor section that allows for prompt replacement on a low cost exchange basis. The head of this 60-cycle unit weighs only 14 lbs. For complete information write Champion Mfg. Co., 3700 Forest Park Ave., St. Louis 8, Mo., or circle **No. 7-13** on the reply card.

Concrete Tractor "Jitterbugs" Without Jumping

Designed to improve slab quality at the same time it reduces finishing time and costs, a unit produced by the Goldblatt Tool Co. introduces a new principle into concrete finishing procedure. Basic function of the tool is to depress larger aggregate below the surface of the slab and to bring a thin layer of paste or fat and fine and semi-fine aggregate to the surface for quick and easy finishing. The tool uses 45 parallel steel rods, each 35 in. long, all attached to two chains. These chains move on four sprockets to drop each rod straight down into the mix as the operator pushes the crawler over the surface of the slab. The rods hold the larger aggregate just below the surface of the slab. Complete details from Goldblatt Tool Co., 1910 Walnut St., Kansas City 8, Mo., or circle **No. 7-14** on the reply card.



Perforated Fibre Pipe

L-M Permaline perforated fibre pipe for land drainage is announced by Line Material Industries. It is available in 2, 3, 4, 5, 6 and 8-inch sizes. It also is available in all sizes without perforations. Features are high strength, light weight, chemical stability and weather and erosion resistance. A complete set of adapters is available for connecting to other types and sizes of pipe. One coupling is furnished with each standard length, providing positive tube alinement. For further information write to Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wisc., or circle **No. 7-15** on the reply card.

New Design Lowers Cost of Large Reactivators

A new, patented design that makes possible the economical construction of Reactivator solids-contact units in almost unlimited sizes has been announced by Graver Water Conditioning Co. Called Inverta-Truss, the new design provides support for all internal equipment resorting to the conventional truss bridge. It is constructed almost entirely out of functional members within the unit. Because it makes use of functional members, the Inverta-Truss requires much less steel than a conventional truss with comparable strength. By distributing the stress evenly it eliminates the need for reinforcement at localized points. The design does not interfere with the free-space area at the bottom of the unit which is needed for the sludge removal equipment. The Inverta-Truss will permit the economical construction of Reactivators up to 200 ft. and more in diameter. Such units would be able to treat about 50,000 gpm of water as compared to the current maximum of about 19,000 to 20,000 gpm. For further data contact Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y., or circle **No. 7-16** on the reply card.

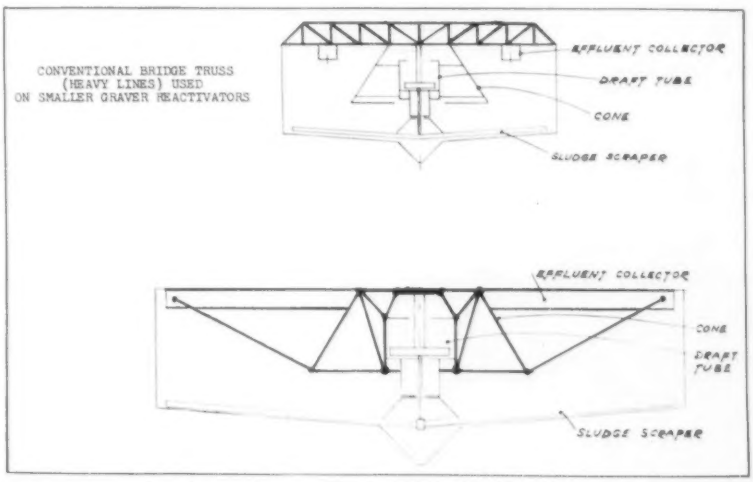
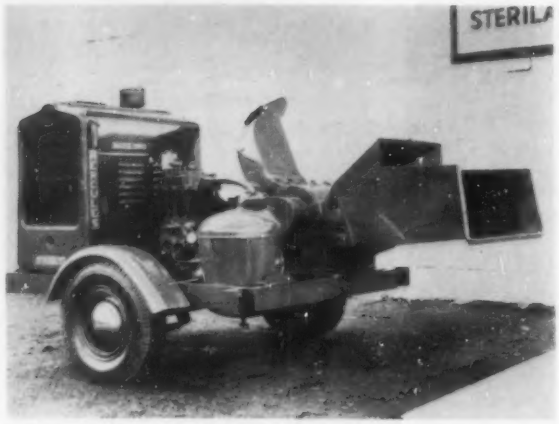


Illustration shows the contrast between the bridge truss and Graver Inverta-Truss

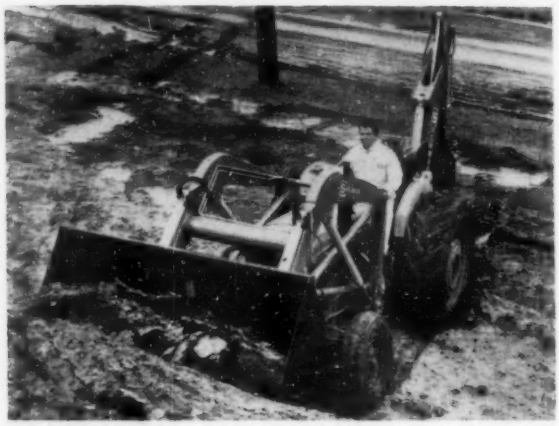
Powerful Wood Chipper



Wood chipper is powered by a Hercules six-cylinder engine

An improved weed control wood chipper featuring a more powerful engine has been introduced by Weed Control Service. Designed for disposal of brush in the clearance of highway and power line rights-of-way, the improved chipper is powered by a Hercules six-cylinder gasoline engine, which delivers 312 foot-pounds of torque at 1300 rpm and 132 hp at 2400 rpm. Outstanding features of this pneumatic-tired, portable chipper include: 1) A patented automatic spring-loaded feed plate; 2) built-in 40-cu. ft. air compressor which supplies compressed air for air-driven saws usually used along with chipper; and 3) Fitchburg chipping unit with 15 by 8-in. rotor. Further information from Weed Control Service, Inc., 2605 S. W. First Ave., Portland 1, Ore., or circle **No. 7-17** on the reply card.

Loader-Digger Combine

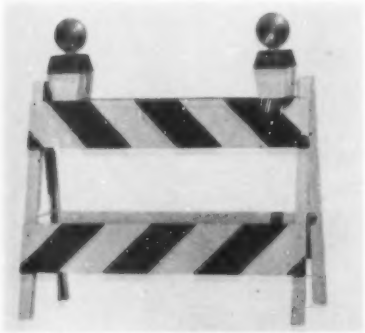


Sherman loader-digger combination will handle many jobs

A heavy duty front end loader and quick-detach digger employing a common sub-frame and powered from a single Sherman Hydra-Loop hydraulic system have just been introduced by Sherman Products. The new loader has a breakaway capacity at bucket lip of 5000 lbs. and a full lift capacity of 2500 lbs. With the series 601 and 801 Ford and Fordson Dexta tractor, the loader has a breakaway capacity of 4000 lbs. and a lift capacity of 2000 lbs. In addition, the new Sherman loader utilizes the same heavy duty sub-frame as the improved Sherman power digger to eliminate the need for an individual sub-frame. The digger, which can be detached in two minutes without the use of special tools, has an uninterrupted pivot arc of 188 degrees, with a reach of 18 ft. at grade and 12 ft. below grade. For more data write Sherman Products, Inc., 3200 W. 14 Mile Rd., Royal Oak, Mich., or circle **No. 7-20** on the reply card.

Pacific Mercury Barricade Kit

Now in Pacific Mercury's line of construction equipment is a complete line of folding barricade kits that permit damaged parts to be replaced, ending the necessity of replacing the entire unit when damage occurs. The PM barricade has marine plywood crossbars available in lengths ranging from two to eight feet. Top crossbars have diagonal black stripes against a yellow background (white base color may be substituted at no additional cost); bottom boards are plain. More information from Pacific Mercury, 14052 Burbank Blvd., Van Nuys, Calif., or circle **No. 7-18** on the reply card.



Barricade will not collapse, once it is set up, even under heavy pressure

Self-Elevating Ladder Assembly

Production of a new spring-loaded, self-elevating ladder rack assembly for use on service bodies having perpendicular rear panels has been announced by the Powers-American Division of McCabe-Powers. The assembly enables one man quickly, easily and safely to erect ladders up to 36 ft. in length. As the ladder is pulled from its stowed position, it moves to the rear of the truck on six rubber-covered rollers in the support-guide section of the assembly. When the user exerts a slight downward pressure on the end of the ladder, four powerful coil springs take over a major part of the job to raise the ladder and steel support braces to a fully-erected position. Stowing the ladder is equally fast and easy. It is furnished with 28, 30, 32, 34 or 36-ft. two-section extension ladder. More information from McCabe-Powers Body Co., 5900 North Broadway, St. Louis 15, Mo., or circle **No. 7-19** on the reply card.

New Center Mount Stimsonite Reflector

A center mount Stimsonite reflector which can be quickly and easily attached to a support structure has been introduced by A'G'A Division, Elastic Stop Nut Corp. The reflector can be installed as either a temporary or permanent marker. A screw, nail or rivet inserted in the hole in the center of the reflector mounts it on metal, wood or concrete. It is available in crystal, yellow or red. More details from A'G'A Div., Elastic Stop Nut Corp. of America, 1027 Newark Ave., Elizabeth, N. J., or circle **No. 7-21** on the reply card.

Roadside Mower Has Rubber Shoed Crawlers

The Forty Mile Mower made by Topeka Hiway Mower, can be converted from rubber tired rear wheels to rubber shoed crawler assemblies in a matter of less than an hour. The crawler assemblies lower the center of gravity and permit the mowing of steep slopes impossible to mow by conventional means. The mower features a 59-hp engine and two transmissions to give a range of speeds from 40 mph while traveling, to 1 to 10 mph for mowing. For details write to Topeka Hiway Mower, Inc., P. O. Box 720, Topeka, Kansas, or circle **No. 7-22** on the reply card.

Lime Paste Slaker and Chlorine Flow Recorder

The paste slaker and a chlorine flow recorder, new developments of Wallace & Tiernan, are pieces of equipment that contain unusual design features which bring new benefits to the water industry. The slaker allows continuous slaking of lime as a paste. The flow recorder provides a record of chlorine feed built right into the new W&T V-notch chlorinators. The slaker provides a torque-controlled continuous water addition which accurately proportions quicklime and water to enable slaking as a paste. In addition, hot water and heat exchange equipment are eliminated. The paste slaker is available in two sizes: 1000 and 4000 lbs. of quicklime per hour, each with a 20 to 1 feed range. The A-733 recorder can be mounted directly in the new W&T V-notch chlorinators. More details from Wallace & Tiernan, Inc., Belleville, N. J., or circle **No. 7-23** on the reply card.

Illustrated is the Wallace & Tiernan A-733 chlorine flow recorder mounted in the W&T A-711 V-notch chlorinator

Wacker Vibro-Rammer is ideal for narrow trenches and hard-to-get-at corners; unit weighs only 115 lbs.

Tool for Compacting Backfill Material

A 3-hp air cooled engine drives the shoe 3 in. up and down 450 to 600 blows per minute in this Vibro-Rammer made by Wacker Co. The shoe does the packing while the engine end of the unit remains nearly steady. Compact design plus almost negligible chassis movement allows the rammer to be used in narrow places. It weighs only 115 lbs. and is operated by one man. It is self-propelled by its own action, so that all the operator does is guide it. More details from Wacker Corp., Hartford, Wis., or circle **No. 7-24** on the reply card.

Transistorized Pipe and Valve Locator

A new transistorized pipe and valve locator has been introduced by Gardiner Electronics. It features a single turn transmitting and receiving coil cast right into the fiberglass case. The transmitter and receiver are powered by 4 flashlight batteries each to give an average life of 1400 hours. The locator uses a total of 10 transistors, 3 in the transmitter and 7 in the receiver. The transmitter has a switch to allow for good and poor conductive ground and the receiver has a 3-position sensitivity switch plus a variable gain control. For more details write Gardiner Electronics Co., 2545 East Indian School Rd., Phoenix, Ariz., or circle **No. 7-25** on the reply card.

Case Economy-Model 10-ft. Digger

A new economy-model digger for trenching, backfilling, loading and utility duties is announced by J. I. Case. The Model 210 backhoe cuts 10 ft. deep, reaches over 15 ft., and side casts or loads into trucks up to 10 ft. high. Without changing position, the unit digs 14 lineal ft. of 4-ft. deep trench, or 6½ lineal feet at 9-ft. depth. Individually controlled telescoping stabilizers permit vertical trenching on side slopes up to 10°. Backhoe is quickly removed for installation of front or side mowers, or a score of quick-hitch tools for grading, landscaping, tilling and specialized work. The 1000-lb. capacity loader lifts 10 ft. 5 ins. high, dumps 45°, has 30-in. reach and 8-ft. 5-in. clearance for quick dump-and-go. Loader bucket (11, 13, or 18-cu. ft.) cuts 5 ins. below grade, rolls back 17° at ground, tilts 90° forward for easy backfilling and finishing. For more details write J. I. Case Co., Utility Sales Div., Racine, Wis., or circle **No. 7-26** on the reply card.

New M-B Contain-O-Pack System

M-B Corp. announces the availability of the new M-B Contain-O-Pack, a complete, low cost containerized refuse system. The system consists of a M-B packer body; hydraulic side-loading boom; and hinged-top steel containers in various sizes. The 3000-lb. capacity side loader with extendible boom can reach containers on loading docks, over curbs, between cars and over fences. The loading boom can be folded neatly out of the way, allowing hand loading through a 36-in. wide side door for servicing mixed routes. Any standard style of truck can be used with the system. The side loader does not require fish-plating, extra heavy front springs, or other expensive truck modifications. Containers are available in three sizes—1½, 2 and 3 cu. yds. Full information from M-B Corp., New Holstein, Wisc., or circle **No. 7-27** on the reply card.

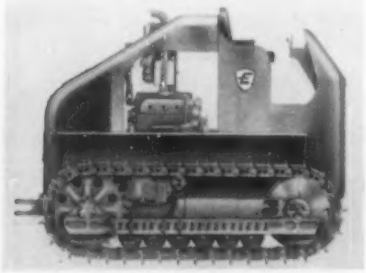
Aerial ladders from Truck Equipment Co. range in height from 24 to 45 ft.

Complete Line of Aerial Ladders

The complete line of aerial ladders announced by Truck Equipment, includes three new series. The line was developed for use by power companies and city street and traffic light maintenance crews. Features include upper ladder section handrails built into fiberglass to insulate workers from high voltage contact; a tri-plane basket to give workers a flat surface regardless of ladder angle; a check valve in the hydraulic raise system to slow descent of the ladder if the hydraulic system is damaged; and ladder heights from 24 to 45 feet. All three series of Truco Aerial Ladders can be mounted on standard truck chassis. More details available from Truck Equipment Co., 3963 Walnut St., Denver 5, Colo., or circle **No. 7-28** on the reply card.

Eimco 103 Crawler Tractor

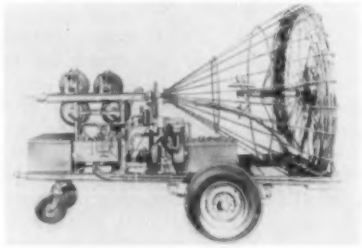
The Eimco 103 introduces many new engineering and construction features to the tractor field. The entire track frame and diagonal brace is cast of electric steel in one piece, smoothly molded to the shapes and varying thicknesses as required to withstand even abnormal stresses.



Tractor is engineered from the ground up to produce an ideal 100-hp machine

The final drive, center housing and main frame are also produced in one heavy steel casting, without bolts or welds. The new series will be available in these basic units. Model 103 is the tractor and dozer, with both angle and straight blades. Model 123, a front end loader, weighs approximately 25,000 lbs. Model 133, a specialized loader for steel mill use, will weigh about 27,000 lbs. The basic bare tractor weighs 15,000 lbs. and develops 13,500 lbs. drawbar pull; the Model 123 has a 1¾-cu. yd. capacity and 23,000 lbs. pull, both increasing to 33,000 lbs. drawbar pull with adequate traction, from a 100-hp diesel engine. More details from The Eimco Corp., P.O. Box 300, Salt Lake City 10, Utah, or circle **No. 7-29** on the reply card.

Super Hydrodder Sewer and Conduit Cleaner



Stewart's Super Hydrodder features exclusive hydraulic drive and positive pneumatic feed. Reel holds 1000 ft. of rods and unit can use any size rod

The Super Hydrodder, announced by W. H. Stewart, has hydraulic drive and positive pneumatic feed. There is no wasted energy due to the very nature of a hydraulic system. If the push or thrust of the tool is resisted by foreign matter, or debris, in the sewer or pipe, hydraulic power automatically increases the rotation of the reel, which causes the tool to rotate (or drill) faster. No manual adjustments are needed. When the resistance is overcome the hydraulic force automatically re-distributes itself back to the forward thrust of the rods while still maintaining sufficient torque at all times. With positive pneumatic feed, the rods are practically hand fed through the machine. Greater, surer thrust is assured because the rod, as it passes through the drive wheels, is in constant contact with pliable rubber. More details from W. H. Stewart Inc., P. O. Box 767, Syracuse, N.Y., or circle **No. 7-30** on the reply card.

56-HP Longitudinal Concrete Saw

Model C-560 saw has two cutting heads

Clipper announces the development of an all-new 56-hp concrete saw, specially designed and engineered to give fast, efficient, accurate sawing of longitudinal control joints. The Model C-560 is equipped with two independently controlled cutting heads positioned in tandem. Either blade may be quickly and easily positioned as the pivotal cutting heads are actuated by a fast acting ball bearing positive screw feed. Each cutting head is equipped with its own pressure equalizer spring which cushions the blade shock and greatly increases blade life. The unit is equipped with four smooth tread compaction roller type tires which have a large contact area with the slab. This wide wheel tread gives the unit traction to go in soft mud or on dirt shoulders. Complete details from Clipper Mfg. Co., Suite 226, 2800 Warwick, Kansas City 8, Kans., or circle **No. 7-31** on the reply card.

Warn Hubs Available for New Ford 4-Wheel Drives

Warn selective drive hubs, Model FL-2, for the new Ford spicer axle 4-wheel drives are now available. Warn locking hubs make it possible to disengage the front wheels from the drive train when the vehicle is to be used in 2-wheel drive, thus eliminating drag, and whine caused by the wheels turning the front end assembly. The free-wheeling effect of Warn Hubs reduces wear on gears and tires, saves gas, makes steering easier, and increases vehicle usefulness. They are easily installed in a few minutes on the new Ford models F100 and F250 with spicer axles, without removing the wheels. The wheels can be removed at any time without removing the hubs. Complete details from Warn Mfg. Co., Riverton Box 6064, Seattle 88, Wash., or circle **No. 7-32** on the reply card.

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NEWS OF ENGINEERS

JOHN BUMSTEAD has become an Associate of the consulting engineering firm of Alden E. Stilson & Associates.

F. F. ALDRIDGE, Senior Sanitary Engineer of the Public Health Service, has been transferred from the San Francisco regional office to be Chief Sanitary Engineer for the Division of International Health of the Service. F. S. KENT, Sanitary Engineer, has been appointed Regional Program Director for Sanitary Engineering, San Francisco Office.

FRANK A. MARSTON, a partner in Metcalf & Eddy, Boston, has been nominated for president of the American Society of Civil Engrs.

WILLIAM M. WRIGHT, formerly Superintendent of Sanitation for the City of Hollywood, Florida, has been appointed Director of Public Works. He succeeds Mitchell G. Ware, who becomes Street and Parks Superintendent. Mr. Wright will be succeeded by Earl E. Eberlein, foreman of the city's incinerator since operations started in July, 1958.

KENNETH D. CUMMINS, formerly associate professor of civil engineering, University of Detroit, has been appointed technical director of the American Concrete Institute. While at the University, Mr. Cummins taught soil mechanics, highway engineering and reinforced concrete and structural steel design.

HAROLD A. MOSHER, assistant director of engineering for Eastman Kodak Co., Rochester, N. Y., has been elected president of the NSPE.

DR. GEORGE J. RESNIKOFF has been appointed director of the department of Industrial Engineering, Illinois Institute of Technology, Chicago.

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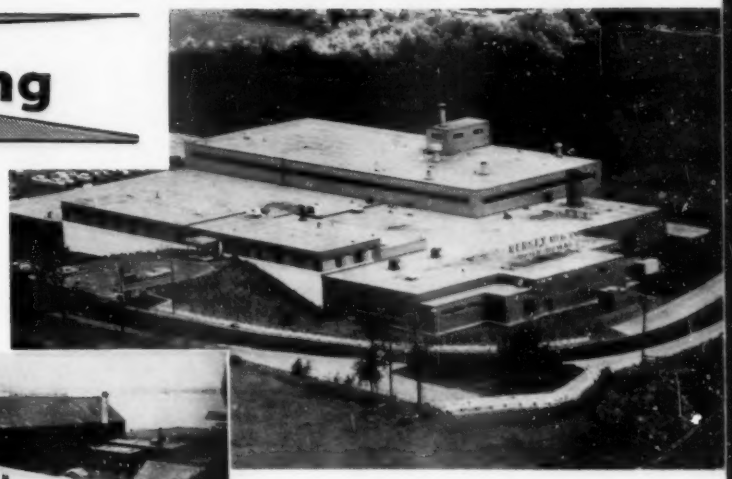
—Worth Seeing

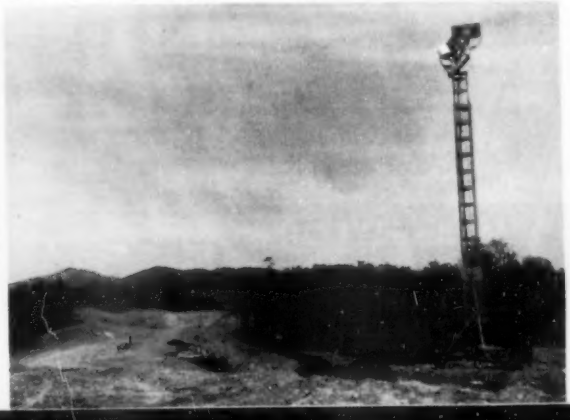


Here at a glance you see the 100-year progress of Hersey Mfg. Co., Dedham, Mass., makers of water meters since 1885. The best of New England tradition combines with one of its most modern plants, with three generations of Herseys continuing at the helm.

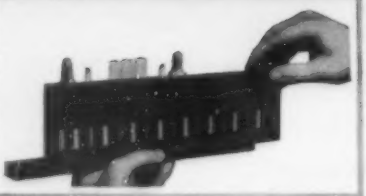
At Miami International Airport, nearly 23 miles of aluminum 3 KV direct burial cable supplied by Kaiser Aluminum & Chemical Sales, Inc., were installed to furnish power to 400-plus aluminum lighting standards positioned in this parking lot and along traffic areas, access roads, ramps and overpasses.

Magnified in all his civic loathesomeness is the "Litterbug," Philadelphia style. This 12-foot creation was a feature of a Clean-up, Paint-up, Fix-up campaign inaugurated by a mid-city parade.

A dramatic night-time roadbuilding demonstration sponsored by the Thompson Tractor Company of Birmingham, Ala., featured the Thompson 'Wide-Lite" portable lighting system. Powered by a Caterpillar D311 Diesel electric set, the system employs a series of telescoping steel towers each supporting three lights using 1,000-watt color-corrected mercury vapor lamps. In the demonstration, eight towers with 24 lights were used to bring near-daylight to one-half mile of road.



FAST!



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Here's a really fast way to get data for trouble-free water system and sewage plant operations. Taylor Comparators give you quick, accurate pH, chlorine determinations that help you control coagulation, filtration, chlorination and algae in water treatment. To test, just fill the center tube with treated sample, and move color standard slide across until colors match. You then read values directly from the slide. The entire operation takes only minutes—and no technical knowledge is required. Also available—Taylor Comparators and Midget Testers for control of swimming pool water.

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W. A. TAYLOR AND CO.
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by Arthur K. Akers

★ **Russell W. Wetjen** becomes vice president and general manager, Buffalo Meter Co.

★ PUBLIC WORKS' advertisers and their agencies figured heavily in the 1959 Putman advertising awards. Dempster Brothers, Knoxville, and **Sam B. Newman** of their Lavidge and Davis agency won one. Graver Tank & Mfg. Co., East Chicago, with the Ullman Organization as agency won another, including a $1,000 check.

★ **Roy Blair Everson,** president Everson Mfg. Corp., Chicago, calls our attention to the opening of the 79th annual convention of the AWWA on July 12 in San Francisco as coinciding with his 80th birthday. We congratulate the still-active Mr. Everson and insist that this is no mere coincidence!

★ **L. F. Heckmann** is elected vice president, sales, for the Union Metal Mfg. Co., Canton, Ohio, makers of metal lighting standards.

Mr. Heckman

Mr. Rogers

★ **Edward J. Rogers** is elected to the board of Koehring Co. He is also president and board chairman of the Layne-Northwest Co. and chairman of the board of Layne-Bowler.

★ **H. J. Longmore,** 34 years with Sprague & Henwood, Scranton, Pa., is now a V.P.-sales.

★ **"Griff" Griffin** of Wallace & Tiernan came in to see us with news that he had won an all-expense trip to Miami Beach for his wife and himself with the slogan he submitted in the Dodge automobile contest. Its inspiration was his Dodge.

★ **N. Young DuHamel, Jr.** is elected vice president for sales and advertising. Centriline Corp., New York.

Mr. DuHamel

Mr. Sammons

★ **William L. Sammons** will fill the newly-created position of general sales manager, B-I-F Industries, Providence, R. I., and direct repair and export sales departments also.

★ Tractomotive Corp., Deerfield, Ill., is being acquired by Allis-Chalmers Mfg. Co. Tractomotive has just won National Safety Council's highest industrial safety award.

★ The live and growing Douglas Fir Plywood Association adds six men to bring its field promotion staff to 58, in 10 cities.

★ **Robert M. Hatfield** has been appointed vice president and general sales manager, domestic sales, by Combustion Engineering, Inc.

★ Baughman Mfg. Co. expands at Jerseyville, Ill. with purchase of a huge existing plant.

★ **James E. McCauley** is appointed vice president, Orangeburg Mfg. Co. division of The Flintkote Co., makers of fibre pipe and conduit.

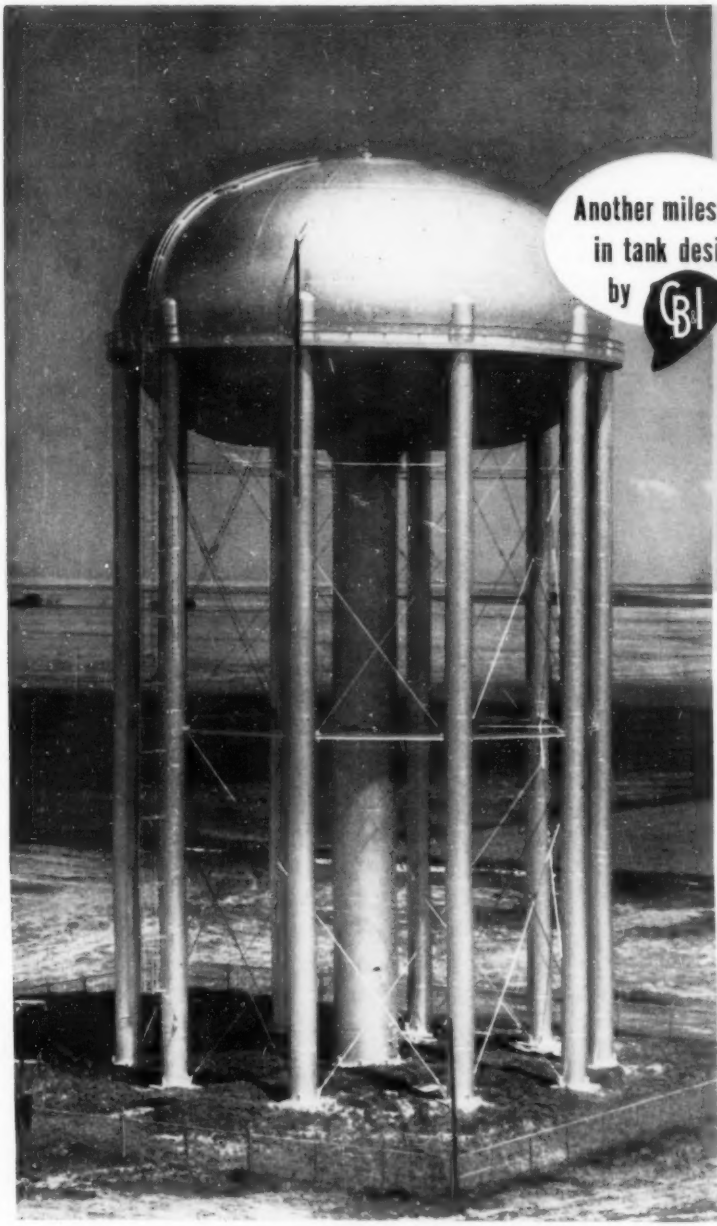
★ **Dale Riedel** is new Kansas City district manager of Holan Corp., manufacturers of utility truck bodies and power devices.

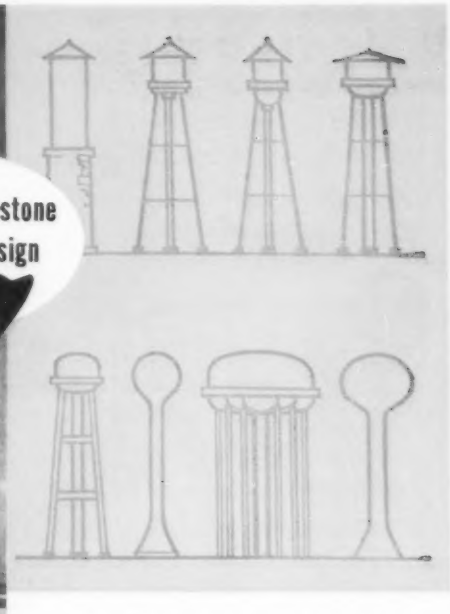
★ J. I. Case Co. re-elects **John T. Brown** board chairman, **Marc B. Rojtman** president.

★ **G. A. Robinson** is again re-elected president, National Clay Pipe Manufacturers.

★ The good old days: When a teenager went into the garage and came out with the lawnmower.

—*Huber-Warco News*





Water needs of growing Pampa, Texas, are served by this CB&I-designed Horton Spheroidal tank. Structure has 1,000,000 gallon capacity, is 76 ft. in diameter, 100 ft. to bottom and has 35 foot range in head. Consulting engineers were Roberts, Merriman & Bowden.

1,000,000-GALLON HORTON® SPHEROIDAL TANK serves Pampa, Texas

When a new tank was needed to provide dependable gravity flow pressure and keep pace with peak load demands in a normally arid, sandy and hill-less region —Pampa, Texas, authorities looked to the experience of CB&I's creative engineers.

The result was a 1,000,000-gallon capacity Horton SPHEROIDAL tank—the newest design in a pioneer family of Horton tanks which date back to 1893. "First cousin" to the Waterspheroid® and "brother" of the Radial-Cone bottom design . . . the Spheroidal tank provides large diameter and a shallow tank depth to store a large volume of water within a low range in head.

The Pampa Story is typical of how CB&I ingenuity continues to serve America's growing need for attractive, tight, *welded steel* tanks that can be designed, engineered, fabricated and expertly erected—to fit local conditions. Write for further information on the *Spheroidal* tank or for the Bulletin on Radial-Cone tanks.

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HORTONSPHERES® FOR GAS SERVICE

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There's no waste water from a V-notch

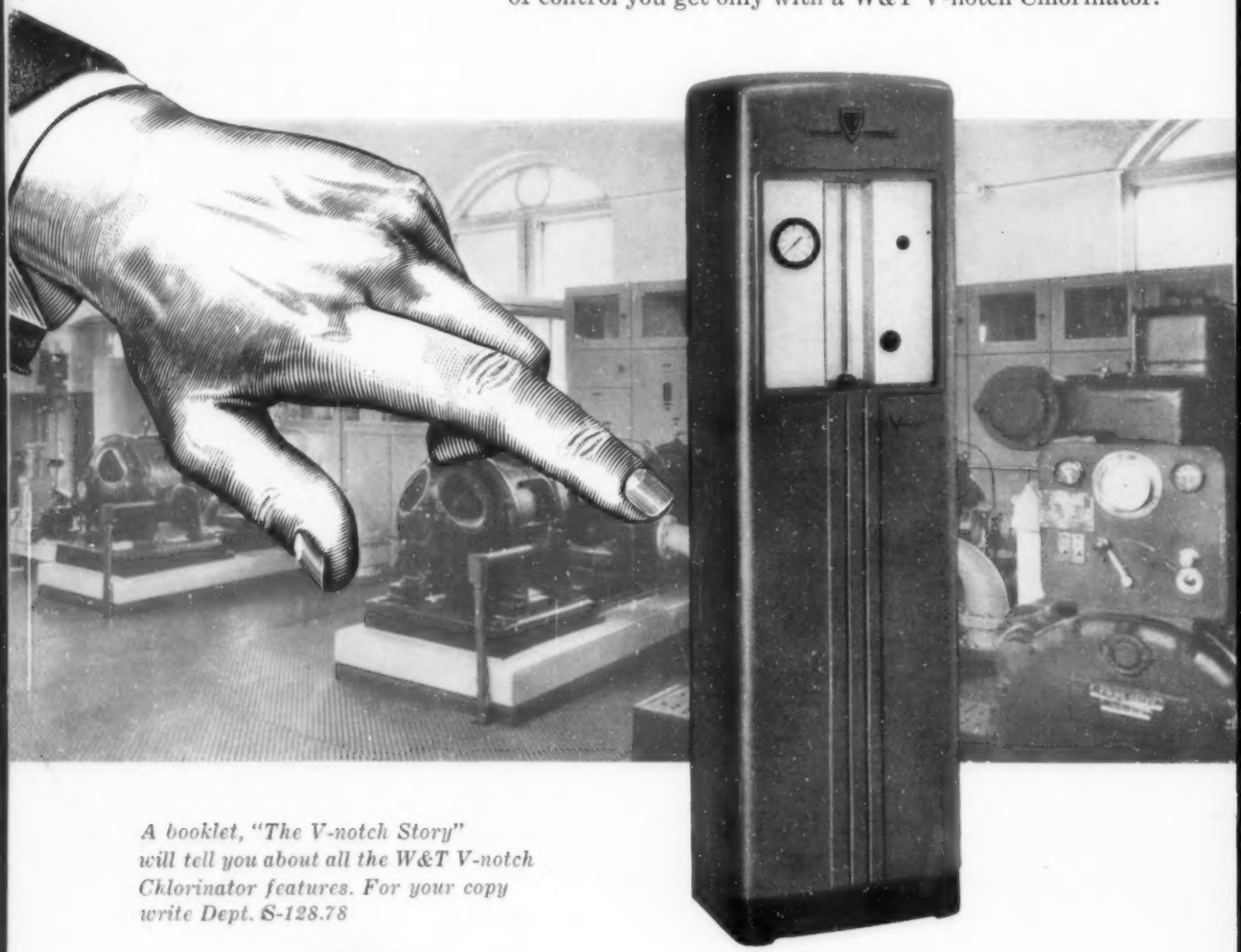
Why?

Because a V-notch Chlorinator needs no auxiliary water supply.

You can plan on clean, dry chlorinator rooms with no messy drain—no chlorine gassing back. And best of all... gone forever is the high cost of wasted auxiliary water.

And, of course, the right plastics make the whole chlorinator chlorine-proof.

Yet these are just added benefits to the main job: Simple, dependable, wide range chlorine control. The kind of control you get only with a W&T V-notch Chlorinator.



A booklet, "The V-notch Story" will tell you about all the W&T V-notch Chlorinator features. For your copy write Dept. S-128.78

WALLACE & TIERNAN INCORPORATED

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